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Telephone Engineer

VOL. 31. No. 11 CHICAGO

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THE Research and Development Department of Automatic Electric Inc. has been a continuous and important factor in the growth and success of the company since the very first days of its inception. Its function at first was to make practicable and workable what was then but a vague and nebulous idea; its function since that time has been to constantly improve and perfect the automatic idea, always having for its aim a more convenient, more rapid and accurate telephone service at the lowest possible cost.

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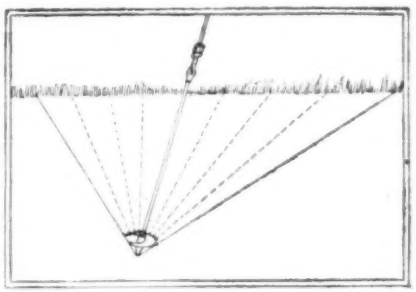

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Picture to the right shows a pole line anchored with Matthews Scrulix Anchors in Wisconsin swamps. The crew worked from tie rafts to make installations.

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Telephone Engineer

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Smaller Exchanges Need More Selling Effort

We have heard repeatedly and have commented in these columns upon the assertion that the smaller exchanges are not experiencing the growth that is taking place in the larger centers. Recently some figures came to our attention that caused us to give some thought to this situation.

One of the Bell companies in a central state publishes station growth statistics in its employees' magazine. This particular company has 35 exchanges in the group having between 500 and 1000 stations. Eliminating exchanges purchased, these exchanges had a growth of 1174 stations between Jan. 1 and Oct. 1 of the present year or a growth at the rate of 6.4 per annum. A group of 34 exchanges having between 300 and 500 stations is growing at a rate of 5.2% per annum and a group of 56 exchanges between 100 and 300 stations is growing at the rate of 3.6% per annum.

The bright and newsy house organ of the Rochester Telephone Corporation of Rochester, N. Y., also carries statistics of its various exchanges and a collection of the figures into groups of similar sized exchanges shows 10 exchanges between 500 and 1000 stations growing at the rate of 3.3% annually; 4 exchanges between 300 and 500 stations growing at a rate of 6.4% and 13 exchanges between 100 and 300 growing at a rate of 4.0%.

Since the growth rate of the Bell company referred to is about 6.5% for the entire system and of the Rochester company is about 5.5%, the indications are that the smaller exchanges are not lagging very far behind the general average.

If it is a fact, as other figures seem to show, that the smaller exchanges of the country are practically at a standstill in growth, it would seem that the condition is not universally true. It is probable that a reason can be found for the situation where growth has ceased and our guess is that the real reason is the absence of selling effort on the part of the manager of the small exchange.

A few years ago, the small exchange manager was active in securing new subscribers and a new arrival in his community seldom remained more than a few days without a call from the telephone man to find out if telephone service was needed. Now the general tendency is to wait for the new business to come into the office rather than to go out after it. Practically every community can use more telephone service than it now has and there is still plenty of opportunity for growth if the management will make the proper effort to secure the new business that is available.

Remember "It's Wire You Talk Over"

"It's the wire you talk over," said the manager-installer-lineman-bookkeeper of a small country system in commenting upon the rebuilding of a line by a nearby larger company. He had called attention to the fact that the neighboring company had worked over one of its lines, placing fine new poles and cross arms onto which it had transferred the same rusty wires which had been carried along the old line.

Commenting on his own lines, he admitted a certain run-down-at-the-heel appearance of his pole lines, but was proud of the condition of the line wire. He had replaced many miles during the past summer and was planning more replacements during the coming year. Tests of transmission on his rural lines proved his point, for they all came up sharply and clearly.

There is real wisdom back of this remark of the operator of one of the despised small country systems. It is a surprising fact that many companies spend large sums on pole replacements and leave old wire in service. Both good poles and good wire are required for good service and when lines are to be rebuilt it is a good thing to remember that "it's the wire you talk over."

Tele-Talkative Habit a National Asset

Commenting upon the relative use of the telephone in the United States and in England, our London contemporary, The Telegraph and Telephone Journal, ascribes the difference to what it calls the "tele-talkative" habits of Americans. Americans certainly are "tele-talkative" if that term means that they use the tele-

phone a very large number of times daily. However, it must not be understood that they use the telephone merely for the use itself. They have discovered the amount of time and labor that can be saved by its use.

The English journal does call attention to one fact that is not stressed sufficiently in discussions of usefulness of the telephone, namely, that the occasional user may receive just as much value from his telephone as the frequent user because of the sense of security and the feeling of availability.

Class C Earnings Must Be Increased

There would seem to be a distinct connection between the relatively poor operating showing of Class C companies and the activity in buying and selling of companies in this class. In his convention address, President F. B. MacKinnon of the United States Independent Telephone Association said that 22 out of 69 Class C Companies had changed hands. The operating ratio, including rents, taxes and other deductions of this class of companies was 81.9% against 76% and 75.9%, respectively, for Class A and B companies. The ratio of the amount available for interest and dividends to fixed capital for Class C companies was 4.9% against 6.4% for Class A and B companies.

Obviously, the Class C companies have not been keeping up in earnings with their larger neighbors and this may be the reason why so many owners have listened to offers for their properties and have sold when they were offered what was considered to be a fair price. Likewise it illuminates somewhat the problem of those who have been buying properties of this and the smaller Class D.

While the earnings of Class C properties expressed as a ratio of the investment in fixed capital have not been adequate, it is true that many of these properties have made very nice showings when the earnings have been compared to outstanding capitalization. In other words, the ratio of capitalization to fixed capital has been low due to reinvestment of earnings. What the new owners can do with them remains to be seen.

If the properties are capitalized to the very limit of a spot reproduction cost appraisal, the danger of ultimate default of bond interest unless substantial rate increases of rates can be secured has been repeatedly pointed out. The damage to the industry as a whole if this happens in any important number of cases is apparent. On the other hand, if the purchasers are content with an operating profit based on a reasonable capitalization and will bring up the properties to the point where the average earnings of Class C companies are equal to that of the two higher classes, they will have done the industry a real service.

Enforced Ethics a Safeguard of the Business

Probably the most significant action at the Independent convention concerned the adoption of sharply defined qualifications for membership in the association. Two good ends are the purpose of such an act: the protection of the Independent telephone industry from thoughtless or willful bad practice in establishing a corporate structure for any unit in the Independent field, and protection of investors by identification of securities that have some endorsement by the industry's recognized practical authorities. The two ends are so closely related that separation would be difficult.

It is a bold thing for an association to set out to do, but it undoubtedly is a safeguard for the reputation of Independent telephone securities. The Independent association has devoted itself to a wholehearted and able effort to put the smaller companies in such shape that their financial structure would be sound, by making available a wealth of expert advisory talent on every phase of the smaller companies' operations.

Putting into actual operation such a plan as is involved by the convention resolution on membership qualifications involves considerable detail work and the eagerness of the organization's officials, directors and members to undertake the task is a splendid indication that the association is a strenuously constructive organization rather than just a "rally 'round the flag" body as are far too many industrial associations.

Defense of the public interest and fidelity to the public trust can never be disregarded as duties of any telephone association that functions properly, and to keep the record in these respects as clear as in the past the United States Independent Telephone association has moved to do the one thing that lies within its power in protection of the financial reputation and future of the business. To assure the investing public that any of the association's member companies is deserving of support in whatever financing is proposed places a heavy responsibility on the U. S. I. T. A. As the organization is willing to assume this burden we are of the opinion that every member company might well line up solidly in the cause. There are mistakes of the past that still exact penalties and make financing difficult for some of the smaller companies. They are natural dilemmas and honestly faced. The association has made manifest its willingness to help in these cases. But in those cases where frenzied finance threatens the U. S. I. T. A. has prepared a needed danger signal.

Good Housekeeping in the Telephone Exchange

By RAY BLAIN

Just as some women are good housekeepers and keep their homes neat and clean at all times, so are some telephone managers good housekeepers. They take pride in seeing that their central office and all of the equipment is continuously clean and shipshape. I believe that to say a man keeps his exchange shipshape is one of the best compliments that can be paid him. Go on most any ship, large or small, and you will note that the decks are washed snow white; all brass is polished and everything is well painted. This seems to be an unwritten law of the sea. There are ships, such as coal barges and the like, that are exceptions to the rule, but the term shipshape that I have in mind does not apply to them. This unwritten law of the sea is the same as the one that applies to the telephone world. It can be seen when looking over any large well managed telephone exchange. I do not infer that all the small exchanges are not well maintained. Some are just as shipshape as the larger systems, but carelessness is usually found in the smaller systems, although I can't think of a good excuse for it.

I served some of my early days in a telephone exchange under a hard master and when I didn't have anything else to do I knew enough to grab a dust rag, feather duster or hand bellows and get busy. Cleaning equipment these days with a small vacuum cleaner especially provided for the purpose is an easy matter, but we didn't have these modern conveniences in those days. In later years I appreciated the necessity of this strict cleaning routine but at the early time I did a lot of grumbling.

I recently visited the exchange that I believe wins the cup for poor housekeeping. There were a pile of telephone directories, magazines and toll tickets on top of the switchboard. The key shelf was marred and carved. In the rear of the switchboard a pile of relay covers was lying on the floor. The panels were open. The storage battery cabinet was standing open, the battery jars were dirty and the sand in the trays wet. Small coils of jumper wire were lying and hanging around everywhere. These conditions all considered made it a safe bet that the service was suffering. I looked inside the switchboard and found an accumulation of dust on everything so thick that it could be scraped off with a knife. The man in charge said that they were having a lot of poor transmission trouble. I suspected this before he mentioned the fact. I asked him if he ever tried cleaning the dust out of the equipment and especially the relay contacts. He stated that he did one time but that it caused so much trouble that he decided that it was much safer to just let it alone. Even the two Black Crows know "you can't do that."

In Spotless Town

As a contrast to this I some time later visited a large automatic exchange that I believe was the most spotless place that I have ever entered. Personally I do not believe that there is a more beautiful thing than an automatic switchroom and this one had a few extras. They had some method of ventilation that circulated washed air and kept the room at a certain pressure excluding the dust or rather making it impossible for dust to enter. With this system it was necessary to keep the doors and windows closed at all times, but this did not make the room depressing. In fact this was the only ideal climate I have ever experienced, and I have been in California, too. I had heard that there were telephone exchanges kept so clean that one could not dirty a white handkerchief anywhere and I proved it here. I was advised that in this particular exchange before these dust prevention methods were installed several cases of poor transmission were traced to dust and that a particle of dust in a contact had been found to measure as high as seven transmission units loss.

Although the small exchange manager cannot usually have such an expensive system of dust elimination, he can see that all relay covers are kept in place and switchboard panels closed when not actually working on the equipment. The inside of the cabinet, cable forms, key pans and bottom of the switchboard should be wiped out frequently with a rag slightly moistened with oil or a good grade of furniture polish. Cheese cloth is inexpensive and very suitable for this purpose. This will prevent the accumulation of dust inside the switchboard and will go a long way toward preventing it from entering relay contacts and other places where it will cause trouble.

Cleaning Methods

Relay contacts should be cleaned periodically with carbon tetrachloride as described in a previous article in TELEPHONE ENGINEER or can be just burnished with a contact cleaner which is just a flat piece of steel slightly sand-blasted. Never under any circumstances use sand paper, emery cloth or any other abrasive in cleaning relay or key contacts. The outside woodwork of the switchboard should be cleaned by rubbing it frequently with a good grade of wax or furniture polish. Switchboard cabinets usually have a very good finish when received from the factory. This can be retained for years with a very little effort. The switchboard plugs should be polished frequently, using jeweler's rouge or some other approved plug polish. Never use ordinary metal polish to clean switchboard plugs as it sets up a corrosion that damages the insulation between the conductors. Proper method of cleaning switchboard plugs was also described in a recent issue of TELEPHONE ENGINEER.

Use a rag slightly moistened in mineral oil or furniture polish to wipe off motor-generator and ringing machines. This can also be used for cleaning the power panel, conduits and cable runways. Power machines may not be works of art but they can be made things of beauty. I knew one man who went so far in this direction that he painted all of the power machines and connecting conduits with white enamel. The first enamel turned yellow and then cracked off from the heat of the machines, but he thought so much of the idea that he finally found a paint that would stand the test and his power room was certainly a pleasing sight even though unusual.

I believe in the proper lubrication of generators and motors, but the average attendant seems to think that they should swim in grease like Salvation Army doughnuts. While it takes a lot of grease to make a good doughnut, usually a small amount properly applied is all that is necessary to properly lubricate a bearing. If a bearing is loose and drips oil then provide a small copper pan to catch the drip instead of permitting it to run onto the generator base and then to the floor. Concrete piers for power machines and connecting conduits and runways should always be kept well painted.

Suitable floor covering plays an important part in keeping down dust in a

telephone exchange. I believe that the ideal floor covering, and the one perhaps most commonly used in telephone exchanges even though it is expensive, is the battleship linoleum. While this is the best and due to its long life, perhaps the cheapest in the long run, there are several cheaper grades that will answer the purpose. When sweeping a floor in a telephone exchange some good sweeping compound or wet sawdust should be used to prevent raising dust. The floor should be mopped frequently.

Power and battery rooms, being usually in the basement, have concrete floors. I have found that strips of ordinary three--ply rubberoid roofing laid down in front of power machines or battery cabinets makes an excellent floor covering. Its only objection being that chair legs cut holes in it. This can be prevented to some extent by placing glass insulators on the chair legs. The roofing, due to its being a rubber compound, acts as an insulator and is a safeguard to the attendant while working around the current carrying machinery. The roofing after being walked on and scrubbed for a time assumes the appearance of black rubber matting and will wear for years. The places between the strips can be painted any color desired. Some of the new iron paints known by various trade names will be found ideal for this. The rubberoid strips can be painted or waxed, but personally I prefer them left in their natural state.

While windows must be cleaned, I have never been willing that they be cleaned with Bon Ami or any other cleaner that dries, leaving a white frosting that must be rubbed off. When this frosting is rubbed off it flies about the room in a form of dust which can accumulate in the equipment and a small amount sometimes start up a harmful corrosion. This is especially true where moisture such as the moisture on switchboard plugs from the operator's hands can get to it.

A furnace heating system will usually prove a good investment in a telephone exchange, as with open stoves it is practically impossible to prevent dust from entering the equipment.

While a vacuum cleaner is an ideal arrangement for cleaning equipment, a cleaner especially designed for this purpose with the necessary attachments and small enough to carry about the equipment is the only kind that can really be used to advantage.

I have known of cases where compressed air as used around garages for inflating tires were used to clean telephone equipment with disastrous results. The reason for this is that this air contains moisture that does more harm to the equipment than the dirt does.

For sanitary reasons the operators' headsets should have the mouthpieces cleaned and disinfected at least once per week.

While cleanliness and freedom from dust are very essential for the proper operation of any electrical apparatus it is especially true with telephone equipment. The manufacturer makes every effort to protect the different parts from the accumulation of dust, but unless a small amount of time is spent periodically by the maintenance force in cleaning the equipment and preventing the accumulation of dust there is every probability that it will not function as it should.

If it is not considered necessary to keep an exchange neat and clean for appearances sake alone, then a cleaning routine should be tried out over a certain period and it is believed that a noticeable improvement will be made in the telephone service rendered. Some exchanges though old and with equipment considered obsolete, are neat, clean, well maintained and giving a wonderful quality of service. As mother used to say, "You can be excused for wearing old, patched pants if they are clean."

Veterans' Yarns Inspired by Exhibit of Phone Relics

A corner of the relic room showing William Hubbard's collection

Chicago, Ill.—Plans of the Independent Pioneers for a museum of interesting relics of the industry's development took definite shape with the display of many items for such a collection was made as part of the U. S. I. T. A. exhibits.

Especially Wm. Hubbard, John Z. Miller and Stromberg-Carlson got busy when the Pioneers announced their intention of starting a museum and the display of relics centered around their contributions. The exhibit was one of the focal spots of the convention and attracted many old-timers who compared yarns on equipment similar to that displayed.

Mr. Hubbard went to considerable trouble in getting together the following items that were shown as his part of the display:

The first 75-wire switchboard installed by Chicago (Bell) Telephone Co. at Elgin, Ill., exchange, August 1881.

The first 50-wire switchboard, installed for the Citizens' Independent Exchange, in Marengo, Ill., by Wm. Hubbard in 1895.

Terminal wire case and lightning arresters for the Elgin Exchange used in 1881 by Chicago (Bell) company.

Telephone business sign, used by Wm. Hubbard and erected on the corner office (ground floor) Merchants' Building, northwest corner Washington and La Salle streets, Chicago, "Telephones for Private Lines Sold Outright," in 1880.

Map showing acoustic (mechanical telephone) business line and construction running from Merchants' Building, corner Washington and La Salle, diagonally across Washington street, southeast, south through court and alley west of Brevort hotel, crossing Madison street diagonally to alley south, then running east through arcade, across Clark street into a second story office, which is now south end of Morrison hotel, in 1880.

Various makes of acoustic and magneto telephone; no battery whatever and exchange systems used in years, 1879-1895.

Original models of Dr. S. D. Cushman electric talking boxes, used on regular telegraph line running out of Racine, Wis., in 1851, also regular make of the "Cushman Battery Transmitter."

Photographs of the "Pioneer Telephone Exhibits" (the most complete of any other collection) now owned by the Purdue University, were also exhibited.

Independents Batter Problems at Annual Conclave

Chicago, Ill.—Marshalling the vigor and brains that were mustered in abundance from its ranks the United States Independent Telephone association at its annual convention held here October 18-21 reaffirmed the expert opinion of the substantial condition and rosy future of this section of the telephone industry.

Departmental sessions that dealt with the various details of telephone work were featured with brass-tack presentations of the recommendations of many of the leading lights of the business. The general sessions had two notable addresses, one the presidential address of F. B. MacKinnon and the other the talk and demonstrations of S. P. Grace, general commercial engineer of the Bell Telephone Laboratories. The two convention features rounded out a program of a constructive and inspirational character that was pronounced by the approximately 1,000 telephone men and women in attendance one of the most interesting and helpful conventions in Independent history.

F. B. MacKinnon was unanimously re-elected president of the Independent organization and carried over with him J. B. Earle, George W. Robinson and E. D. Glandon as vice-president, and Charles Deering as secretary-treasurer.

New directors elected were W. G. Bickelhaupt, Aberdeen, S. Dak., Wallace L. Cook, Chicago, and J. N. Cox, Cookeville, Tenn. Directors re-elected were: J. A. Agee, Harold L. Beyer, E. D. Glandon, W. J. Lescure, F. B. MacKinnon, Houck McHenry and Walter J. Uhl.

Prior to this convention there was some speculation as to the number of new faces that would be in evidence, due to the past year or two activity in buying and selling of telephone properties and how many of the old guard would pass out of the picture, due to the changes of ownership. It was the general impression that there was not much change in personnel among the well-known characters in the industry present at the convention and foundation for this impression was found in the presidential address, which gave evidence, contrary to the opinion of some, that there was a relatively small number of new men in the industry as a result of the sales. It was shown that the substantial Independent interests are buying the greater number of the Independent properties for sale.

Committee's Report

Attendance at the first session of the convention on Tuesday afternoon was much in advance of previous records. The program was devoted to reports of officers and the various divisions, to appointment of committees and to consideration of resolutions. Secretary C. C. Deering presented his report of the financial affairs of the association. He pointed out that the revenues were derived principally from pledges by telephone operating companies and manufacturers, the rate for telephone operating companies being .08 of one per cent of gross revenues. In 1925 the revenue of the association increased 16.7 per cent over 1924, although a smaller number of companies contributed. The membership roll of the association showed 565 telephone company members and 104 manufacturers and miscellaneous members, making a total of 669.

The report of the accounting division was made by W. L. Lemon, auditor of the Lincoln T. & T. Co., chairman of the accounting division. Mr. Lemon's report was one of progress. The major projects handled during the year were the revision of the plant accounting handbook and the review of Interstate Commerce Commission depreciation order No. 14700 to assist the association attorneys in presenting matters before the commission. Recommended projects include a revision of the accounting text to conform with changes in accounting procedure which will come when the final depreciation order is made, and the preparation of an accounting handbook for class C companies.

A. L. Stadermann, chief engineer of the Citizens Independent Tel. Co., Terre Haute, Ind., chairman of the plant division, presented the report of that division. This also was a report of progress. Many of the projects of the plant division are being carried out as a co-operating body of the American Engineering Standards Committee and work of standardization is necessarily slow.

Close Important Projects

One of the main projects brought to a close during the past year was the completion of the revision of the National Electrical Safety Code and particular attention was called to Handbook No. 10 of the Bureau of Standards relating to construction of electrical supply and communication lines. Other work is in progress with the American Committee on Inductive Co-ordination. The plant division also co-operated with the accounting division in making a study of the Industrial Commerce Commission order on depreciation.

At the close of Mr. Stadermann's report, President McKinnon announced that the time had come for the organization of the plant division into districts in the same manner as the accounting division and that it was hoped that the district organization might be set up during the coming year.

C. C. Deering gave the report for the Traffic Division in which he called attention to the fact that more than 1500 young women had enrolled in the association's correspondence course in toll operating and that 611 had completed the course and received certificates. The committee now has under consideration the advisability of organizing a similar course in local operating.

Following the division reports the president appointed a nominating committee consisting of P. C. Holdoegal of Rockwell City, Iowa, T. H. Runkel of Portage, Wis., and Lloyd Wright of Jamestown, N. Y.

A resolution adopted unanimously by the Board of Directors was then read. The purpose of the resolution was to define more explicitly the conditions of membership especially with reference to companies which will not follow standards of practice which have been or may be adopted by the association. After some discussion the motion was passed by the association without a dissenting vote.

J. B. Earle of Texas then presented a resolution favoring the reduction of federal corporation tax from 13½ to 10 per cent of net income. This motion was speedily disposed of by an unanimous affirmative vote.

During the course of the afternoon President McKinnon introduced a number of guests of the meeting and members who had come from long distances.

Among those called upon were Mr. Sweet, representing the New York State Commission; Francis Dagger of Canada, Mr. Ovitt, secretary of the Vermont association; Messrs. Mendeck and Irwin of California; Mr. Gates of Oregon, and Mr. Davies of Spokane, Wash., were representatives of the far west, while Mr. Brorien of Florida and Mr. Still of Texas were called upon to represent the south, not forgetting the ladies.

Miss Anne Barnes was introduced to the meeting, although few telephone men do not know Miss Barnes and her work for the operators.

Gives "Family Circle" Idea

As usual, the Wednesday morning session was one of the best attended of the convention. The large assembly room was crowded during the entire program. President McKinnon first introduced Henry A. Barnhart, president of the Indiana Telephone Association and a former president of the national association. Mr. Barnhart spoke briefly, telling of his pleasure in meeting so many old friends again. He referred also to the present speculative condition in the telephone field and predicted one of three alternatives for those who are buying telephone property at some of the recent price levels. Either they must cut expenses and let the property depreciate; they must pass interest and dividend payments, or they must raise rates to an exorbitant amount.

Of especial interest was the annual statement of President McKinnon concerning conditions in the industry. The association, said Mr. McKinnon, has been endeavoring to steer a safe course for the telephone industry and it is concerned not so much with immediate dangers which are not so serious, but it is concerned with mapping the course so that the rocks of the future may be avoided.

Many new men have been coming into the telephone industry and some of them do not know the business and are surprised at the attitude of existing companies toward them. Mr. McKinnon aptly compared the Independent group to a large family and said that it had the interest of a family in the man from outside who was to marry into the family circle. It is interested in knowing what kind of a man he is and how he would act when he comes into the family.

One of the things which concerns the industry is the type of security issues that is being made in some cases. What will be the reaction of the public to the overissue of securities, to the issue of unsound securities and the adoption of unsound operating practices? It was pointed out that principles that have been established over a long period can not be abandoned without damage to the individual company and to the industry.

Many of the circulars issued by financial houses offering telephone securities show an unsound condition when a careful analysis is made. In some cases bonds in excess of what property was formerly carried in the books have been issued and on top of the bonds were placed issues of preferred and common stock. The operating margins after adequate provision for depreciation have been barely enough to carry the bond interests. A severe business depression can not mean anything else than a "sour" security issue.

The question arises as to how far has the shifting of ownership gone. The association has found some difficulty in keeping an accurate record, but it has kept fairly close in touch with the situation and its figures are nearly right. In the past year and one-half, 750 exchanges have been transferred. In Iowa about 130 exchanges have changed hands, while in Indiana, Kansas and Texas the number approximates 100 each. Expressed in terms of a total of 14,000 exchanges and 9,000 companies, the percentage of change has not been large. Of 52 class A companies, 4 have changed hands. Of 73 class B companies 17 have new owners and of 69 class C companies 22 have been transferred. Many of these changes are the cause of no concern, for the property has passed into the hands of people of responsibility equal to greater than that of the selling interests. The activities of the promoters have been centered largely about grouping of smaller exchange units. What they are going to do with them is the real problem.

Many telephone owners are coming to realize that a business which is good enough to attract purchasers in numbers is a business good enough to stay in and have decided to retain their properties. Others have held on through a sense of responsibility to the public and to a loyal corps of employes who have helped build up the business. Mr. McKinnon then read the advertisement of the Fayette Home Telephone Co., Lexington, Ky., "Keeping Faith with the Public," and commented on it as an excellent statement of the position of an enlightened telephone management.

Renewing the statistical work of the association, Mr. McKinnon gave the results of some of the tabulations from annual reports of various classes of companies. The group of 200 companies now in the A, B and C classes is operating 1,447,000 stations and has an investment of $239,000,000. The increase in stations in 1926 was 121,000 and in fixed capital was $26,000,000. The increase in stations among Class A companies was 12.3 per cent, while among class B and C was 3.3 per cent.

The revenues for the 200 companies for 1926 amounted to 25.4 per cent of fixed capital, which was practically uniform for all classes of companies. The earning available for dividends and interest was 6.3 per cent of fixed capital for all companies with class A and B companies, each earning 6.4 per cent, while class C companies lagged behind with only 4.9 per cent on fixed capital. The annual depreciation rate based on entire fixed capital is 4.3 per cent for all companies varying from 4.1 per cent for class B to 4.6 per cent for class C companies. The association has no figures for depreciable property, but the rate of depreciation expressed as a percentage of depreciable property would necessarily be higher.

The ratio of all operating expenses including rents and taxes to gross revenue for all companies was 76.4 per cent, being practically 76 per cent for classes A and B and 81.9 per cent for class C.

These figures are an eloquent demonstration of the difficulties which men who are grouping small companies are likely to meet.

Among the other major problems before the association are those relating to the depreciation order of the Interstate Commerce Commission, which are being considered by the plant and accounting division and the various proposals for federal regulation of security issues which are likely to be before Congress during the coming session.

Outline Commercial Plans

Following the statement of President McKinnon, R. F. Wilder, general commercial superintendent of the Tri-State T. & T. Co. of St. Paul, Minn., who has been made chairman of the newly organized commercial division of the association, made a brief address on "The Commercial Division—Its Possibilities and Scope."

Mr. Wilder indicated the broad scope of commercial work in the telephone industry and showed the differences between that division of the field and the other divisions in which the adoption of standards of practice do not offer such difficulties. He expressed the opinion that the best results would be obtained by using the commercial divison as a clearing house for information which would be brought into its conferences. The work has not yet been planned with any degree of definiteness, but may start with work under a number of general heads. Six of these were suggested by Mr. Wilder; viz: service applications and contracts; billing practice and collection methods; classification of service and rate schedules; directories and directory advertising; development of business, and public relations.

J. W. Baker of the Interstate Utilities Co., Spokane, was then introduced and read a paper on "New Business." Mr. Baker started out to show that an erroneous impression prevails in some corners that the telephone business is a necessity and that no necessity exists for efforts to sell the service. It is true that every one can make use of service and those whose needs are well defined will always have the service. There are others without such well-defined needs and these may not have the service unless

it is sold to them. The extent of the market depends only on the number of social, business and industrial units in a community. There is a necessity of personal selling and the problem is to find the prospective user and determine his needs. Two lists of prospects are made: those who have service and those who do not.

No one likes to be sold anything but an idea may be created in the mind of the prospect that he needs something and then the salesman can supply the need. The call on the prospect who has service may be in the way of an inquiry as to the quality of the service. Later the interview may develop into a consideration of the needs of the prospect for additional service, for an extension telephone, for more use of toll service, etc.

With none-subscribers, the reason for the call may be assigned as the making of a survey for future service requirements. An interview of this type may be led into a discussion of service needs and the possible taking of a contract.

In taking contracts which come into the office, the effort should be more than merely filling an order. A real effort should be made to determine the needs of the subscriber and to fill them properly.

Mr. Baker then described a number of new business stimulators used by his company with much success and gave suggestions as to the best time to sell different classes of service. Among the devices used are the employes' selling campaign, the use of service letters to a portion of the subscriber list and the publication of a magazine for subscribers.

The best months to sell telephones are just before the issue of a new directory. New business also may be solicited when a construction gang is working in an area. Extension sales campaigns are most successful in December. If the company is selling its own securities, July and January are the best months on account of interest payments that are usually made at that time.

Telephone's "Arabian Nights"

A most interesting and important lecture and demonstration was that given at the Thursday morning session of the United States Independent Telephone Association by S. P. Grace, general commercial engineer of the Bell Telephone Laboratories, Inc., of New York. Mr. Grace spoke of the work of the Bell Telephone Laboratories in research and development and demonstrated many of the important devices that have been produced as a result of the work of the laboratories. Mr. Grace paid compliment to the work of a number of Independent engineers who have had a prominent place in the development of the art and mentioned by name some whose work is finished but who have left a lasting mark, particularly W. W. Dean and Fred Baer.

"It has been said that 90 per cent of our prosperity has been due to research," said Mr. Grace and he then developed the thought that research must be continued by industry if we are to keep ahead of other nations. Slavery is necessary for the development of a cultural civilization, but the modern nation has mechanical slaves, while the ancient civilizations were built up on human slavery. The latest member of the Bell telephone system is the Bell Telephone Laboratories, which has been assigned the duty of doing all the laboratory research for the system.

Research is no longer the work of the individual scientist working in his private laboratory, but is now a group effort. As an example of group research, the television may be given. Specialists in optics, mechanics, electro-technics and other branches had to co-operate to bring the system into successful operation. There is now a staff of 3,700 people in the laboratories, "working beyond the sunset," in Mr. Grace's expressive term.

The lecturer then showed models of the harmonic telegraph and the first telephone of Alexander Graham Bell, and in behalf of E. K. Hall, vice-president of the American T. and T. Co., presented them to Mr. J. K. Johnston, secretary of the Pioneer Independent Telephone Association, as additions to the collection of early telephone equipment that is being assembled by the pioneers.

Loading Coils' Big Saving

Taking up specific applications of research that have been put into practical use, Mr. Grace spoke of the work of Heaviside and Pupin in working out the mathematical theory that resulted in the loading of telephone line. The research and development laboratory then took up the work and produced designs of coils that were suitable for use in working lines. It has been estimated that a saving in capital investment of $200,000,000 has been made by the application of the loading principle. The first coils were made on cores of fine wire which was later superseded by powdered iron and later by a new magnetic material called permalloy. The modern permalloy coil occupies only a small portion of the space of the older coils and a saving of several millions of dollars per year in capital investment has become possible through its use.

Referring further to permalloy, its application to the loading of submarine telegraph cables has resulted in the production of cables having operating speeds from 5 to 8 times those of the older non-loaded cables. The material, permalloy, is an alloy of approximately 80 per cent nickel and 20 per cent iron produced through a special heat treatment and has several hundred times the magnetic effect of iron. An interesting theoretical research has been conducted to determine the reason for its properties and an explanation has been advanced that it is due to the fact that no energy is lost in magnetization due to the opposite effects of expansion and contraction of iron and nickel under magnetic changes.

Another metallurgical development is a treatment by which all of the crystals of iron may be made to point one way, producing a material 200 times as magnetic as iron. A sample of this material in the form of a round wire was shown, and to the observer, on account of the peculiar crystal structure, appeared as a square wire. A commercial use for this has not yet been developed, but when a need for a material having these characteristics arises, the fundamental work for its production will have been done.

Another magnetic material is cobalt-steel which is capable of producing permanent magnets several times stronger than tungsten-steel. While the laboratories did not have a part in the actual development of this material, it has done much work in finding applications in telephone apparatus, such as in the permanent magnets of head receivers.

Only briefly did the lecturer refer to the development of the vacuum tube and its applications to telephone repeaters and carrier current systems, but he stated that it had made possible the use of long distance cable to the point where one cable has a capacity equal to 16 open wire leads. To provide open wire long distance lines equal to the long distance cables that will be in service by 1935 would require an outlay of $350,000,000 more than the cable will have cost.

Cable Research

Research work on cables themselves has resulted in the production of larger and larger cables as far as capacity is concerned without increasing the sheath diameters. A study is now being made of the possibility of forming a wood pulp paper insulation directly on the wire of the cable. Studies are also being made of the alloys used in cable sheath.

Turning to other lines of development, Mr. Grace spoke of the work of the laboratory in fields outside that of electrical communication. The artificial larynx which may be used by persons who have been rendered speechless by throat operations was described and demonstrated. Another device is one to teach deaf persons to recognize speech by feeling. A special electro-magnetic device with finger points responsive to various frequencies is used.

In recording speech, wonderful advances have been made by the use of electric devices. Notable examples are the Orthophonic Victrola and the Vita-

(*Continued on page* 40)

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

CHAPTER V

In the last installment we considered the subject of inventorying the underground cable plant. At the close of the installment it was suggested that we would next review the subject of recording data pertinent to the central office and subscribers' station equipment. However, before passing on to this latter subject, there are a number of thoughts in connection with the underground plant which I would like to pass on to you, the readers of TELEPHONE ENGINEER.

It is most essential that the task of inventorying the underground plant shall be carried out in a systematic manner. The value of the plant involved is bound to be large, and furthermore the conduit and cable plant is necessarily somewhat complicated. The major portion of the plant is underground and out of sight, and, therefore, certain problems present themselves which are not encountered in connection with the aerial plant which can be readily seen by the field inspectors.

Another thought which may prove of interest is the following: A thoroughly experienced field inventory man can accurately record all data pertinent to fifty or more manholes per day. Probably a novice could not record that data for more than fifteen or twenty manholes per day. Of course in cold weather, when manhole tops are frozen tight, both of these figures may have to be modified. Also, in cold weather it will be found advantageous to take an extra man along who can devote his energies exclusively to opening the manholes. In many instances it will be found necessary to dig the ice and snow away from the manholes and then to kindle a small gasoline blaze in the crevice between the top and the manhole frame.

Another point which should be borne in mind in connection with the underground plant is that manholes should be properly guarded while open for inventory purposes. Many municipalities have very strict ordinances with respect to the proper guarding of open manholes. In some cases the municipality requires the guard posted at the open manhole to carry a red flag—while the manhole itself has to be protected by a portable gas pipe railing. Other municipalities even go so far as to stipulate that every open manhole shall be temporarily covered with a heavy metal screen—said screen being substantial enough to support a weight of several hundred pounds per square foot.

It is well to study all municipal ordinances and observe them most rigidly.

Now a word as to the detailed method of recording manhole data. It is a known fact that most manholes are bound to be rather dirty. It is, therefore, hard for one man to observe the data and record it. On the other hand, it is quite difficult for two men—a recorder and an observer—to work within the narrow confines of the ordinary manhole. Hence the writer is suggesting the following procedure which he has adopted in many instances with most satisfactory results.

Have the recorder stand at the manhole opening. He can then serve the double purpose of acting as manhole guard and recorder. The observer, down in the manhole, can call off all data in pre-arranged chronological order. When this method is adopted the recorder should call back all measurements and data to the observer as fast as he records them—this affording a double check and assuring the observer that the recorder has heard his voice over the ordinary street noises.

It is remarkable how fast and how accurately two men can work—adopting the aforedescribed method—after they have had a little experience.

Another thought to be borne in mind with the recording of the underground plant is that distinctive treatment may be required with respect to the main and subsidiary conduit leads. Having located two manholes, one can be pretty sure that the conduit runs straight between these two manholes. When we come to the subsidiary conduit, however, we can locate the manhole, and the terminal hole but we cannot be sure that the intervening subsidiary conduit follows a direct route. Often devious turns and twists are necessary to avoid subsurface structures such as water pipes, gas mains, etc.

In connection with this series, little has been said with respect to the house and block cables. Nowadays, fortunately, most plant records are so kept as to afford accurate data, and these records, as a rule, may be used and accepted with but slight checking in the field. As a matter of fact, it is almost necessary to accept these records as many house and block cables are not readily accessible and cannot be viewed.

In reviewing my notes, I find that I have said little or nothing about the toll plant. With one exception, however, it is not necessary to go into this phase of the subject—the matter of procedure is the same—but of course it is necessary to give the proper account numbers. In other words, using the "fifty series" for toll, instead of the "forty series" for exchange. In other words, exchange underground cable is account 244, while toll underground cable falls under the classification account 54.

The exception I referred to is submarine cable account 256. We also sometimes encounter exchange submarine cable, and this of course falls under the caption Account 246, and the same remarks apply to both accounts.

First describing the account—in accordance with the stipulations of the Interstate Commerce Commission, "this account should include the cost of submarine cable, cable towers, loading coils, cable boxes and fittings, and other materials used in the installation of such cables, and other costs incident thereto."

For obvious reasons it is impossible to measure submarine cables in the field. There are several ways, however, by which the necessary data can usually be obtained. In most plants submarine cables are rather uncommon, and it will usually be found that a record of the length of the cable, as installed, is available somewhere in the records. If not, it is probable that some employe will remember the time that the cable was placed and from whom it was purchased, and then by writing to the manufacturer the necessary information can be obtained.

If neither of these methods proves practicable, the length of the submarine cable can be computed theoretically by ascertaining the total resistance between the terminal points and the resistance per lineal foot.

Other data as to cable terminals, cable towers, anchorage, etc., should be obtained and recorded in sufficient detail to facilitate the appraisal.

Another phase of the outside plant

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which we have not covered thus far is the right of way.

It is a well-known fact that no telephone property of appreciable size was ever constructed without a good deal of dickering between the representatives of the company and the owners of the property abutting on the pole lines. It is usually customary to assign one or more trained right of way agents to the construction forces, who devote all their time to smoothing out the difficulties incurred in the construction of highway pole lines, or better yet, to forestalling any possible trouble by preceding the construction gangs and explaining to the property owners just what is to be done.

Unquestionably the salary and expenses of these right of way agents are part and parcel of the construction cost of the property, and they should be included in a reproduction valuation.

Where poles are placed on private property it is of course necessary to have a right of way agent or some other authorized representative of the company secure either verbal or written permission for the use of the property.

Another item of expense which is inevitably incurred in connection with the construction of a telephone property consists of payments for damage claims incurred during the construction period. No matter how careful the men may be, accidents will happen. It may be that in placing a pole a cement sidewalk is broken or a fence or railing damaged. Telephone companies are usually ready and willing to fully compensate the owners of damaged property, and all cash payments made in settlement of such damage claims are chargeable to the right of way account.

Still another element of right of way cost is involved in the attachment of a telephone company's wires or cables to pole lines of other companies. In constructing a new plant it is often desirable to utilize an existing pole line belonging to a foreign company, rather than to go to the expense of building a new line for the exclusive use of the telephone company.

In a case of this kind not only is it necessary to secure the permission of the company owning the poles, but also, in the majority of cases, to stand the expense of minor changes in the position of the foreign company's wires to provide space for the telephone wires on the poles in question. All of this expense is chargeable to the right of way account.

In appraising a telephone property constructed long before the date of appraisal it is necessary, of course, to estimate the right of way expense, just as it is necessary to estimate many of the other costs encountered in a reproduction appraisal. The following estimate of the cost of securing various types of right of way is the result of the consideration of a large number of actual cases:

Cost of right of way per pole for city poles on public highways....$0.25
Cost of right of way per pole for city poles on private property.... 2.00
Cost of right of way per pole for rural poles on public highways.. .25
Cost of right of way per pole for rural poles on private property.. 1.50
Cost of right of way per pole for telephone attachments on foreign city poles .....50 cents to 1.00
Cost of right of way per pole for telephone attachments on foreign rural poles ..... .50

It will be noted that the rural costs run slightly lower than the city costs. This is due to the fact that, with the possible exception of where poles are placed immediately in front of his house, the rural owner is a good deal less likely to find fault than a city property owner.

Now taking up the subject of subscribers' station equipment, the inventory of the station apparatus, account 231, comes first.

First taking up the Interstate Commerce Commission's instructions, we find the following:

This account should include the cost of station apparatus, such as telephone sets, intercommunicating sets, bells, backboards, desk stands, coin boxes, protectors, battery boxes, initial batteries and cords, special station switching devices not otherwise classified, and telephone and telegraph instruments or parts thereof when owned by the company and installed for service.

It is obviously out of the question to inspect all of the equipment falling under the heading of station apparatus. A house-to-house canvass of the subscribers' instruments would be very expensive and the resulting slight increase in accuracy of appraisement negligible.

Many companies maintain reliable records as to type of equipment, and the use of these records—supplemented by a field check of, say, 5 or 10 per cent of the total number of instruments involved—should give sufficient data for the appraisement of the station apparatus. However, if there are no records, or if the existing records are bound to be unreliable, a larger percentage of the total should be checked in the field, 10 or 15 per cent. This check is merely for the purpose of gaining an idea of the proportion of the various types and makes of instruments existent throughout the plant.

The Interstate Commerce Commission's requirements are stringent enough to insure a reasonable degree of accuracy in the total number of subscribers' stations carried on the company's books, and the auditor's record of the number of stations can usually be accepted without question.

The subject of inventorying the subscribers' station equipment will be continued in the December issue, and a suitable form suggested for recording data secured in connection with the 10 per cent check.

Charles Norton, Indiana Official, Dies at Columbus, Ind.

Columbus, Ind.—Charles S. Norton, secretary-treasurer and general manager of the Indiana Telephone association died in the County Hospital here Oct. 22, following an operation for appendicitis. He was born in Flat Rock township, Ind., 61 years ago. He was ordained a minister in the Methodist Episcopal church and after being in the ministry three years entered the service of the Citizens Telo. Co. at Columbus, later becoming manager. He was prominent in the affairs of the old International Independent Telephone association and was one of the organizers and an early president of the Indiana Independent Telephone association.

In 1916 Mr. Norton went with the receivers of the Central Union Telephone Co. and when the Indiana Bell Telephone Co. was organized he continued as special agent until elected to the state association office in 1926.

Members of the deceased's immediate family who survive him are his widow and two daughters, all residing in Indianapolis.

The funeral was held at Columbus, Oct. 24, and was attended by a large body of the state's telephone men, headed by Henry Barnhart, president of the association, and C. H. Rottger, president of the Indiana Bell.

Gifford and Wright Rise with Automatic

Chicago, Ill.—R. S. Gifford, formerly superintendent of production for Automatic Electric, Inc., has been appointed sperintendent of manufacturing, in full charge of production including all manufacturing processes. H. B. Wright succeeds Gifford as superintendent of production. Mr. Gifford's first experience in the telephone industry was with the Cuyahoga Telephone Co. as branch exchange manager. In 1903 he became associated with Automatic and in 1910 was made superintendent of production.

Arcadia, La.—J. B. Herring of Arcadia and Carl M. Einhart of Cleveland, O., as co-partners, have brought control of 11 Independent exchanges in northeast Mississippi and hold options on 12 more in that territory. A program of improvement and expansion has been scheduled.

A "Standard" P. B. X. Switchboard installed in the Grayson Hotel, Sherman, Texas, by the Northern Texas Telephone Co.

Monarch *Telephone Equipment*

Branch Office and

A Standardized Line of P. B. X. Switchboards Meet the Requirements of Every Common Battery Exchange

THESE switchboards are divided into two groups, the "Standard" P. B. X. and the "Feature" P. B. X. The "Feature" P. B. X. board contains all of the features of the "Standard" board as well as many others that meet special operating and trunk requirements. The various operating features of the two boards are interchangeable for both manual common battery and automatic service.

The design and construction of these two P. B. X. switchboards is such that every feature that could be desired by the operating company is provided, as well as a degree of standardization never before attained.

Bulletin No. 80 fully describes and illustrates the operation of both boards.

"For Greater Service to Telephone Companies"

American Electric Company, Inc.

State and 64th Streets

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Successors in Business to

Monarch Telephone Manufacturing Co.
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Telephone Construction Material and Supplies

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for Assurance of Uninterrupted Service "COPPERWELD" Telephone Line Wire

The maintaining of normal service under abnormal conditions is the foremost requirement of a telephone system. Galvanized steel or iron wires soon rust and interfere with proper performance, often crippling an entire section.

The use of Copperweld, which cannot rust, insures absolute reliability of service and does away with regular maintenance and replacement costs.

"COPPERWELD"
Products Include:
Line Wire
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Ground Wire
Clamps
Cable Rings
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There never has been, nor is there now, any other "copper-covered steel" or "copper-clad steel" made like "COPPERWELD" —by the Molten Welding Process

"Engineering Data—Copperweld" a book of wire data for engineers and field men, sent on request. Write for your copy.

Copperweld wires "ride thru the storm." They stay up long after copper and (new) galvanized wires of equal and larger sizes are down. Size for size, Copperweld is 75% safer.

Copperweld wire ***cannot rust.*** The copper exterior is permanently and continuously molten welded to the steel core for all time. It can never crack, split or peel.

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Chicago, U. S. A.
Distributor to the Independent Telephone Trade

Convention Exhibits Draw Lively Buying Attention

Chicago, Ill.—Exhibition space at the Independent convention was sold out several weeks before the opening day of the meeting and this gave an accurate forecast of the interest displayed at the various manufacturers' showings of equipment and supplies.

There was a fair amount of ordering done at the convention and promise of considerable business in evidence as a result of the studious buying interest of the convention visitors.

Several demonstrations served to provide a valuable educational note to the exhibits. Automatic had an interesting operating display showing the progress of an automatic call, and several other demonstrating details. Stromberg-Carlson, Kellogg and several other manufacturers had radio equipment in service, a detail that fitted well into the radio program service session held during the convention. A number of the conventioneers journeyed to Freeport, Ill., to observe the Kellogg radio program service installation installed in co-operation with George X. Cannon, manager of the Stephenson County telephone company.

A summary of the exhibits:

A complete display of telephone and switchboard equipment was presented by American Electric Co., Inc. This display had in it a unit position, sectional type board, a combination magneto and common battery board, a one position magneto switchboard having key-shelf supervision, a standard and feature P. B. X. board, and a representative line of switchboard parts.

The extensive telephone display included all models from the standard desk and wall types of the monophones. Included in the monophone display were models in various colors.

American Electric Co., Inc., supply sales department, joined with the Copperweld Steel Co., the Habirshaw Cable & Wire Corp., and the Texas Creosoting Co., in exhibiting Copperweld and Habirshaw wire products Black Beauty poles. American being the sole distributor of these products to the Independent telephone trade, both directly and through jobbers.

From Chicago headquarters American had at the convention: H. L. Harris, president; W. F. Benoist, vice-president, H. D. Currier, vice-president and chief engineer; L. Q. Trumbull, secretary and treasurer; R. G. Faulhaber, sales manager; Geo. O. Wilson, sales engineer; R. W. Siemund, supply sales manager; H. B. Malloy, radio sales manager; W. J. Stanton, railway sales engineer; V. A. Moscow, equipment sales; L. V. Anderson, supply sales and E. F. Kinson, publicity.

Field representatives at the meeting were: H. A. White, manager, Kansas City branch office; P. O. Picot, Ohio; C. W. Snyder, Indiana; F. R. Paris, Illinois; E. E. Donoho, Texas; M. H. Croswell, Wisconsin; D. B. White and L. M. Davies.

American Steel and Wire Co. showed its perfected telephone and telegraph wire, including its "Extra Best Best," "Best Best" and Steel grades, the first being the highest in conductivity, with a weight per mile ohm of 4,700 lbs. to 5,000 lbs.; the second being equal to E. B. B. in mechanical qualities and galvanizing but with slightly lower electrical value, and the third grade being designed for short-line telephone service.

At the Automatic Electric, Inc., exhibit the entrance vista revealed a huge globe encircled by the Automatic dial. The revolving globe and the striking color and light effect made this an impressive and beautiful symbol of the Automatic's world-wide service. A special display cabinet showed the operation of Automatic equipment and the progress of a call, the call being set in motion by mechanically operated hands at each instrument. The new type 24-dial developed by Automatic Electric, Inc., was shown and a vivid exhibition of its durability was apparent in the dissembled dial. New monophones, including the Automatic's induction coil receiver type, also attracted interest. In addition to these features there was a big array of standard Strowger equipment.

For the Automatic Electric, Inc., men, the convention was opened with "Automatic Day" which was held on the day preceding the formal opening of the Independent convention. A luncheon was held for the Automatic men in for the convention, after which the company's men and a number of telephone men visited the factory to examine an operating exhibit of a central automatic exchange with small semi-automatic unattended outlying exchanges of various types was shown. At this exhibit, several different types of small isolated exchanges were shown in actual operation. Of these, four were applications of Strowger equipment to the semi-automatic method of operations, while a fifth unit was full automatic using magneto telephones equipped with dials. The following were five typical applications demonstrated:

1. A main exchange locally controlled by key sets and senders. This was of the common battery type employing selectors and connectors. While semi-automatically operated, all that is necessary for conversion to full automatic operation, is to lock mechanically in its operated position the switching relay of the first selector. The exchange may be operated partly full automatic and partly semi-automatic if desired.

2. A remotely-controlled semi-automatic exchange. This was a selector system employing central battery supply.

3. A magneto or local battery semi-automatic exchange in which the switching of connections and ringing signals were remotely controlled. Disconnects were made by "ring-off."

4. A magneto local battery exchange remotely controlled. In this unit the release of connections was under the control of the switch hook, giving instantaneous release upon hanging up the receiver.

5. A fifth unit consisting of a small local battery full automatic exchange using magneto telephones equipped with dials.

Actual demonstrations under working conditions were made of all these exchanges, showing the extreme flexibility of Strowger automatic equipment, and giving those present an excellent idea of the ease and success with which this apparatus can be applied to practically any conditions with economy both in first cost and everyday maintenance and operation.

Loren Berry, his sales manager, Perry Ballou and J. C. Boush and L. V. Stinson of the staff of L. M. Berry & Co. at the convention told how the company handled its more than $1,000,000 annually of Independent telephone directory business. Almost 900,000 copies of directories are printed each year by the Berry organization of 70 men who handle the Berry complete service of compiling, printing and selling and collecting for advertising in telephone directories.

W. S. Ferguson, the widely-known representative of Lynton T. Block & Co. again was on hand to tell of the company's insurance for telephone companies and received his many friends in the Block room.

F. A. Bowdle showed the full line of telephone company printed forms that represent the benefits of 15 years' specialization in this work.

Victor batteries were on display at the exhibit of the Carbon Products Co.

Chance Co. exhibited its complete line of Never-Creep anchors, the new Chance expanding steel anchors, the Chance capstan pulley block and Chance linemen's wrench. The company's Chicago representative and A. Bishop Chance, Jr., were in attendance.

Greatly appreciated service was given by the Churchill Cabinet Co. in providing one of its de luxe booths near the registration desk, and in maintaining page service for telephone calls. Kellogg and Stromberg-Carlson both had Churchill booths in their displays. N. H. Small of J. H. Bunnell, New York City, eastern distributors for the company, was in charge of the Churchill showing.

Jack Coffey and A. D. Shaumberg handled the affairs of the Coffey System and Audit Co. showing in the Coffey display the details of the Coffey central accounting system.

A large welded ingot from which Copperweld wire is rolled and drawn was shown at the American Electric Co., Inc., display. The company's other products, twisted pair, ground rods, messenger, cable rings, nails, staples, etc., also were shown. E. G. Elg, K. S. Williams and N. V. Clark represented Copperweld.

Chloride accumulator and Exide batteries made by the Electric Storage Battery Co. were put through their paces by Messrs Bend and McCall of the company's Chicago office. There was a good display of Exide batteries for telephone service.

The X type Cook terminal celebrated its first birthday by occupying the spotlight at the entrance to the Cook room. Protected terminals, main distributing frames, substation protective equipment and the well-received Cook true-gap discharger also were prominently on hand. President George Folds, John F. Jaap, Earl Shields, Chester Ruth, D. C. McKee, J. S. Baker and L. S. Persons were on deck.

Happy Jack Crawford again did the honors for Everstick Anchor Co. and officiated at the debut of some new four-way anchors, a new rubber-tired cable chair and the Neverslip cable ring.

F. J. Foster, Chicago manager for the French Battery Co., Emil Halline, Otto Graening, W. H. Conlin and George Stiles, representing headquarters, were at the French headquarters telling the boys tales of triumph by their products, and bore down heavy on the performance of their No. 6 telephone cell and radio and flashlight cells. A new flashlight case was an item of interest.

C. P. Harrah with his Handyman guy stretcher, pole pusher and rapid pole pusher again was making converts to the cause of labor saving. He has the equipment in use all over the world now, he states.

Highway Trailer Co. had a boring machine on exhibition in the lobby of Hotel Sherman and showed motion pictures of the device in action. The Highway exhibit got a lot of well-deserved attention.

Telling details of the work of the Highway boring apparatus were H. M. Raymond, the company's Chicago manager and N. M. Erdahl, George Currey and F. C. Gokey from the factory.

An interrupter type tone machine with no brushes or rings to wear out was one of the features of the Holtzer-Cabot display of a complete line of telephone power plant equipment, which included charging machines, ringing machines and motor-driven ringing interrupters of all sizes.

Al Johnson, the bright young former purchasing agent for Stromberg-Carlson and for several years at the head of the A. J. Johnson Co., was briskly on the job at the convention to keep the field reminded that he carries in stock for its speedy service a full line of line hardware and supplies. Superior friction and rubber tapes, Victor telephone cells, Ace and Electric Storage battery radio batteries, and other items. Al made a feature of the American Steel and Wire company's telephone wire and also showed rubber-covered iron and copper wire. He had his full band of busy little workers in the cause on hand to help him with the boardcasting of his slogan, "Johnson's on the job as your purchasing agent."

Kellogg presented a beautiful new line of P. B. X. boards designed to harmonized with the interior finish and decorations of de luxe business establishments and institutions. The line has splendid selling possibilities and is the Kellogg high standard for service. A four position special demonstration Kellogg Service switchboard with an interesting display panel, was another feature of the display.

Non-interfering harmonic ringing equipment on display was the subject of much interest as was the Kellogg Universal switchboard. Line construction and supply material was present in abundance. The Kellogg radio equipment operating at the company's headquarters provided good entertainment and a splendid demonstration of the quality of the Kellogg radio line.

The Kellogg men in attendance included: W. L. Jacoby, president; H. E. Billington, sales manager; H. D. Hurlbut, A. D. Boal, R. K. Smith, W. Christopher and E. F. McDonald from the Chicago office; M. A. Bellion, supply sales manager; Mac Harland, advertising manager; Chas. Ruge, advertising department; Chas. Reese, supply sales department; S. A. Mounteer, switchboard sales manager; H. M. Stewart and L. Muhlheizler, switchboard sales department. Sales representatives from the different states included Minor Corman, Southern territory; R. B. Miles, New York; J. Houghtaling, Minnesota; H. W. Hogue, Indiana; O. F. Schollenberger, Iowa; J. R. Shipley, Kansas; H. A. Arth, San Francisco branch manager; R. S. Martin, Texas; W. R. Kimmel, Wisconsin; H. B. Dudley, Michigan; F. B. Knefel, Ohio; R. W. Glaser, Illinois; R. H. Coyne, special sales representative, and C. G. Gardner, Oklahoma.

Leich Electric Co. exhibited its full line of telephone and switchboard equipment and made an added feature of the Leich system for remote control of power equipment. Other interesting equipment at the Leich display included a two-position, 200-line, full relay, central battery P. B. X. board, ringing converters and radio equipment. Representing the company at Chicago were: O. M. Leich, secretary and general manager; A. J. Kohn, sales manager; A. C. Reid, chief engineer; T. U. White, sales engineer; J. A. Campbell, Ohio representative; W. S. Fisher, Illinois representative; T. J. Gullion, Wisconsin representative, and Carl Malmborg, Iowa representative.

Claude L. Matthews, vice pres. and treas. of the Matthews Corp. had his band on the display floor to show several new items in the Matthews line. These new appliances included the Traplox anchor, the Matthews Xpandix and the No. 20 Xpandix which is the only five-way anchor made. The new Matthews slack-puller also was on display and received considerable favorable attention. The company's adjustable reel and Woodpecker Telefault also were prominent at the booth. With Mr. Matthews were Lester Boll and Haworth L. Brueck.

K. K. Drane was in charge at the National Cable Compound booth and did a good business in Ever-Protect paste and liquid. The widely-known Steve Isom was compelled to stay at home as the factory burned down a few days prior to the convention and Steve was getting construction for the new and enlarged plant under way. Fortunately jobbers had enough Ever-Protect stocked to care for the demand pending the completion of the new factory.

Eddie Schulz, boy wonder for National Carbon, was in command of the Eveready-Columbia dry cell exhibit, and had as aides-de-camp Dick Brooks and Alvin Zinkan. The National team continued to get plenty of telephone business and presented a new anti-freeze radiator product as a new member of the line.

Movies of the Tunney-Dempsey fight and part of a famous Chaplin film entertained the visitors in Page and Hill's sylvan dell. There was plenty of argument about the fight pictures, but none at all about the merit of Page and Hill poles, according to the eminent Grant Harris, who with the company's president L. L. Hill, F. C. Treat, L. E. Morier and Hart Anderson put the works on the prospective customers.

W. L. Griffith and H. H. Schleppy of the Quick Directory Co. showed a number of its telephone directories.

Wallace Cook, president of the Reliable Electric Co., his widely known buddies, George Rodormer, secretary of the company, and J. E. Steltzer, featured the new 303 central office protector and made an interesting and profitable display of the rest of the company's big array of protective equipment. Reliable reported a good volume of business done at the convention.

H. O. Cauldwell, J. H. Blanchard and Russell Dickson represented John A. Roebling's Sons Co. at the organization's display of telephone cables, drop wires and other conductors.

J. Mayo and Phil Lenz were staging reunions with a host of friends and customers throughout the reunion and when the curtain fell on the convention were able to take back to the Runzel-Lenz plant big orders for cords from companies that had not been on the R-L customers' list prior to this year's Independent meeting.

R. G. Sands and J. C. Ballentyne of the Sands Electric Co. showed a new aerial to underground junction box that was well received. The company's line of protective equipment is getting along at a very pleasing rate, according to the Sands officials.

Adolph M. Seeger exhibited his new Push-Pull jack and found that it made a favorable impression with telephone men. It is a one-man device which can be operated in limited space.

Signal Engineering call systems showed additional revenue possibilities to the conventioneers. The company's sales manager Norman Dickey and its Chicago manager, Dicker, demonstrated the equipment to a large number of interested telephone men.

E. C. Pawley of the Specialty Device Co. showed the company's Bierce guy anchor and guy wire protector.

Charles T. Lamberton again put the Stacy Load Binder through its act and kept the telephone field lined up in good shape for this item of equipment.

Everything for switchboard service from 10-line equipment to 8,000-line service was shown as one of the features of the big Stromberg-Carlson display. In addition was shown the complete Stromberg-Carlson line of telephones, its construction material was presented, and some of its radio equipment was put in the spotlight. The No. 744 combination radio and phonograph got a lot of enthusiastic attention. Among the featured switchboards were the No. 105 standardized magneto switchboard and the Junior multiple board for service up to 600 lines.

Especially attractive were the finishing touches on the switchboards and radio sets. Stromberg-Carlson, according to the conventioneers, has plenty of reason for its pride in its cabinet work.

In attendance at the Stromberg-Carlson room were: W. Roy McCanne, president; George A. Scoville, sales manager; Ray H. Manson, chief engineer; Eugene Reinke, assistant sales manager; E. G. Eidam, assistant chief engineer; John Levis, circuit engineer; J. C. Snyder and R. H. Barger, sales engineers, and Charles E. Heston, supply

manager, from the main office of the company at Rochester, N. Y.

The Kansas City branch of the company was represented by A. J. Roberts, manager; C. Kinne and P. Winemiller, sales engineers.

The Chicago branch was represented by Carl Schafer, manager; H. T. McCaig, assistant manager; P. D. Myers, radio sales manager; M. W. Redmond, supply manager; Ben Woodbury, special representative; C. F. Sanders and Mr. Johnson.

Among the travelers who came in for the convention were J. P. Galligan from southern Missouri, W. C. Caldwell from Minnesota, J. A. Taggart from Indiana, W. J. Pfaender from Illinois, J. E. Finley from western Ohio, A. B. Crawford from western Maryland and Pennsylvania and C. W. Watson from Kentucky and Tennessee.

Simplex jacks for pole pulling, pole straightening and guy pulling were shown at the Templeton-Kenly & Co. booth by W. H. Kreer and P. H. McManus. Two sizes of Simplex pipe pushers also were shown. The Simplex jacks are standard equipment with the Bell and with many Independent companies and with the Western Union and Postal. They enjoy a big international business.

O. M. Goller and L. M. O'Connell were in attendance at the Unique Mfg. Co. display of gasoline and kerosene furnaces and torches. Cut-out specimens of the line were shown to make plain the practical construction. A short balance ladle and a new folding windshield were two of the new features at the Unique display, both of them sharing the commendation given the rest of the company's showing.

G. S. Gaunt and S. J. Hough representing the Waterbury Battery Co. showed the company's Telecell, their primary battery for long-life and constant voltage service. This was the first showing of this battery at a national telephone convention.

T. C. Thompson Automatic's New General Commercial Head

Chicago, Ill.—T. C. Thompson, hitherto general superintendent of Automatic Electric, Ind., and for 24 years one of that organization's corps, has been named general commercial manager to succeed the late Fred Baer. He assumes supervision of sales activities while retaining supervision over the equipment engineering, installation and operating departments.

He has had a long and extensive training which has brought him into intimate contact with the various activities of Automatic Electric, Inc., in serving its customers, both in selling and technical phases.

Philadelphia, Pa.—C. F. Brisbin, formerly with the Bell of Pennsylvania as connecting company supervisor, has been made vice president in charge of Relations and Personnel of the New Jersey Bell Telephone Co.

Rates Study Spurs Plant Revision

By Harry M. Engh,*

Manager of Public Relations, Mutual Telephone Co., Erie, Pa.

Pioneers in the telephone business lost sight of the investment necessary to serve the subscriber, and the ever-present factor of depreciation. It is due principally to the latter that some of our present rate difficulties are now so outstanding and appear distorted in comparison with other rates. Some of the outstanding instances are miles and miles of country pole-line investment, with only a few subscribers. In many cases the total money collected from the subscribers is not sufficient even to maintain the line, without mentioning fixed charges or a fair return on the investment.

I am frank to admit that even our company, one of the few outstanding successful Independent telephone companies in the United States, owns and maintains a number of these parasitic rural lines. One of our "pets" came to my attention this past week for solution, and I am not ashamed to state that I have been unable to solve the problem. The case at hand involves $2,040 in country pole-line investment, which our chief engineer estimates can be rehabilitated for the sum of $3,345—and we receive annually the magnificent sum of $162 in telephone revenue.

Our average plant maintenance of 5 per cent, would in itself, be more than the revenue we receive from this line, not to mention other operating expenses, fixed charges, depreciation, or a fair return on the investment.

Some of you commercial men may pat yourselves on the back, thinking you have not a condition such as this; but all I have to suggest is that when you get back home, pick out a few of your good rural lines and do a little calculating for your enlightenment. A few days of honest study will either send you to a sanitarium or out on each rural line in a campaign to sign up all the possible prospects in the territory. The same condition exists in other classes of service, such as some classes of city service, the only difference is that they are more difficult to solve.

In our attempt to solve our problems, we are studying each individual line which extends beyond the corporate limits of each one of our exchanges. We are eliminating some circuits through the regrouping of subscribers, merging pole lines, cutting out surplus plant, and giving some of our distant subscribers to nearby connecting company exchanges. In one of the exchanges of a connecting company, there were abandoned and removed 600 poles after a re-grouping study, not to mention the miles and miles of wire cut out of service.

I believe our problem today is not one of plant and its enlargement, but it is that of subscribers, their number, and the rates of charge for service. It might be stated, without a desire to cause reflection, that for many years the best thought of our pioneer telephone men was directed to and engaged in the building of plant.

Today, the successors of these pioneers have the plant that was left them and the many problems of re-financing for the rehabilitating of the properties, together with rates of charge that are far from being fair or equitable to the company for the service rendered in some classes of service.

In the break-down of rates there are a number of elements of cost that telephone service should bear regardless of class, and then adjustments made to take care of rates for classes of service unable to carry their pro-rata of the total charges.

In analyzing rates of charge for various classes of service there are a number of factors and costs that must necessarily be taken into consideration, which can be summed up under the following five headings:

1. Depreciation of plant.
2. Maintenance of plant.
3. Other operating expenses.
4. Administration and fixed charges.
5. Fair return on investment.

Before the break-down and consideration of any of the foregoing five factors in rates of charge for telephone service, it is necessary first to break down all plant investments as to toll and exchange; otherwise our maintenance and depreciation of plant would not be correct in its distribution. This last statement is not difficult to make, but in actual practice, it is very near impossible of distribution. However, an honest attempt should be made to analyze plant investments between toll and exchange.

By analysis, I mean the break-down of every capital account, whether it be buildings, equipment, or pole lines, so that if any portion of any capital account is attributable to toll service or to exchange service in whole or in part, such amounts should be distributed in our study.

**Digest of Independent Convention Address.*

I may mention that every item of capital account may have a different method of distribution, such as square feet of space occupied, number of calls handled through toll or exchange, or some other method of pro-rata that would be more equitable under the many varying circumstances we find in the different central office districts. However, a careful analysis should be made, and the logic of the different distributions carefully noted and explained, for I have found in these analyses that the distribution is constantly changing, or that our original thought of distribution was not in accordance with the facts in the case.

After the proper analysis of capital account and its distribution to toll and exchange, the first two of our five headings —"Depreciation" and "Maintenance"— can be more equitably distributed.

Depreciation will be the simpler as it is a direct charge on the basis of the physical plant in service. Maintenance, however, is a little more difficult of distribution for there are certain maintenance expenses which are general in nature. Some of these general maintenance expenses can be distributed on the basis of fixed toll and exchange maintenance charges, whereas other maintenance expenses should be analyzed from the viewpoint of investment attributable to toll and exchange usage, while still other maintenance expense should be distributed on the basis of the demands made by toll and exchange service.

The third and fourth of the five factors are "Other Operating Expenses," and "Administration and Fixed Charges." These can be pro-rated and distributed to toll and exchange on the basis of service demands on each class of expense. Some are chargeable direct, while others, e.g., pay stations, rest rooms, school, and administration, should be considered from varying angles.

The fifth of the five factors is "Fair Return on Investment" and is controlled entirely by the amount of investment in the respective classes of service.

The requirements for the afore-mentioned five factors are now separated and assigned to the two prinicipal classes of service—toll and exchange. The total amount, now designated as exchange requirements, should be distributed as accurately as possible to the various classes of exchange service. This distribution should be made after carefully studying the individual items of exchange expense, for some are chargeable to a specific class of service, while others are fixed costs on a subscriber basis, and still others on the basis of line requirements for respective classes of service.

Conditions, you undoubtedly all appreciate, will vary so widely that it is practically impossible to formulate a rule which would apply in all cases or under all conditions. What may appear as a proper or correct distribution for specific expenses in one corporation, may not be correct or suitable for another company, due to varying conditions in service and local demands of classes of subscribers.

There are other conditions affecting distribution of expenses such as pole lines paid for in part or in full by subscribers, rental for use of facilities by other classes of service, guaranteed rentals on certain classes of service and many others, any of which will affect the specific rates of charge under observation.

CONVENTION CALENDAR.

ILLINOIS TELEPHONE ASSOCIATION
November 17 and 18.
Springfield, Hotel Abraham Lincoln.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.
November 23 and 24.
Toronto, Prince George Hotel.

SOUTH DAKOTA TELEPHONE ASSOCIATION
January 10, 11 and 12.
Huron, Marvin Hughitt Hotel.

ARKANSAS TELEPHONE ASSOCIATION.
January 16 and 17.
Little Rock, Hotel Marion.

NEBRASKA TELEPHONE ASSOCIATION.
January 17, 18 and 19.
Kearney, Ft. Kearney Hotel.

NORTH DAKOTA TELEPHONE ASSOCIATION.
March 6, 7 and 8.

Bell to Reduce Toll Rates December 1

New York City—Another reduction in rates for talking to distant points over the telephone lines of the Bell System becomes effective December 1st on interstate business.

The last change in the rate schedule for interstate long distance service became effective October 1, 1926, and represented an annual saving to the public of about $3,000,000.

The schedule that goes into effect on December 1st will result in a further annual saving to telephone users of $1,500,000 according to the estimates of the Bell operating companies based on the public's use of long distance facilities.

The new schedule applies to station-to-station rates to points 400 miles or more distant. The greater the distance the greater the reduction. For a New York-San Francisco call, for example, the basic station-to-station rate for three minutes is reduced from $11.30 to $9.

It will cost $6.00 instead of $7.25 to talk from New York to Denver on a station-to-station basis. For a call from New York to St. Louis the reduction is from $4.05 to $3.50.

The evening rates (applying on interstate calls from 7 p. m. to 8:30 p. m.) between the points affected by the change will be reduced to a level about half way between the night rates and the new day rates. The rates after 8:30 p. m. remain at approximately their present levels.

Pioneers' Perennial Pep Enlivens Meet—E. D. Schade Is Chief

Chicago, Ill.—E. D. Schade of Johnstown, Pa., was elected president of the Pioneer Independent Telephone association and J. K. Johnston of Indianapolis, re-elected secretary-treasurer of the organization during the session held at the time of the U. S. I. T. A. meeting at Chicago. The Independent pioneers belied their antiquity by a display of vigor that came into prominence when the association's surprise party was staged at the Davis Hotel luncheon. The affair was a "Standing Room Only" event at the start but the patriarchal committeemen by briskly moving about despite the handicaps of crutches, wheel chairs, flowing white whiskers and other impedimenta of old age, got the customers all seated for a merry luncheon.

Grandpa Rodormer, Old Uncle John Jaap and the rest of the first white settlers on the Independent frontier gave much inspiration to the younger generation of telephone men by showing that, despite casual comment to the contrary, the telephone industry does not unduly age its grand marshals or its menials. The thoughtfully inclined probably reflected on the rapid progress of the business when they considered how many of those who had figured in the establishment of the telephone industry on its present basis were still men to whom the years of life's price were ahead. One of the pleasant little details of the Pioneers' party was the table at which sat William Hubbard, manager of the Elgin, Ill., exchange in 1881, and several of his operators of the early days.

Tribute was paid to the memory of the Pioneers who had passed on during the last year, George Fuller, Charles North, P. C. Burns, Wm. Castor, Mary Cornin and Fred Baer being specifically mentioned.

Studying Details of Telephone Work

By E. R. COLLINS
Wire Chief, Manitoba Telephone System

CHAPTER X

We can break our line into several smaller equal sections as in Fig. 69. Such a pair is called a twisted pair, and the crossing over of the wires is called transposing. This is taken from two Latin words, trans, *across*, and pono, *to place*. Of course it is understood that where the wires are crossed over, they do not touch, but are insulated.

Systems of transposing are carried out through the whole of the telephone line as far as possible. Where wires are bunched in cables they are always in twisted pairs. The twisting is done by machinery and the twists are very uniform. The equal spacing of the twists is a very important feature of this scheme.

Transformer or Repeating Coil

We will encounter the repeating coil in our simplest telephone circuits, so that

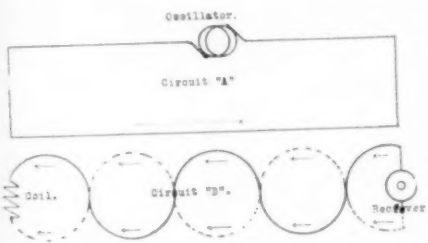


Fig. 69. Showing the effect of several transpositions in a pair.

it will be as well to deal with the explanation of the repeating coil before we go any further.

In Fig. 27, we wound two coils on a nail. The inner coil we called the primary, and the outer the secondary. This was a simple example of an induction coil, or transformer, or as one type is called in telephone practice, a repeating coil.

In Fig. 51, chapter 7, we described a solenoid coil wound on a spool. This consisted of about 2 pounds of No. 22 D. C. C. wire. When a lamp was connected in series with this coil and 110 volt 66 cycle current, the lamp would burn. When the iron bolt was inserted, the lamp went out. This was due to the inductance of the coil being increased by the presence of the iron core. Wind over this spool another two pounds of 22 D. C. C. wire and connect as shown in Fig. 70.

Leave the ends of the new coil separate, and connect the lamp in series with the primary and the 110-volt 66 cycle current. Shove the iron in till the lamp is put out. With the iron still shoved in, connect the ends of the new coil. The lamp will light again.

Now we know that it was the adding of the iron that put the lamp out. Therefore it must have been the magnetic effect of the coil that kept the light from

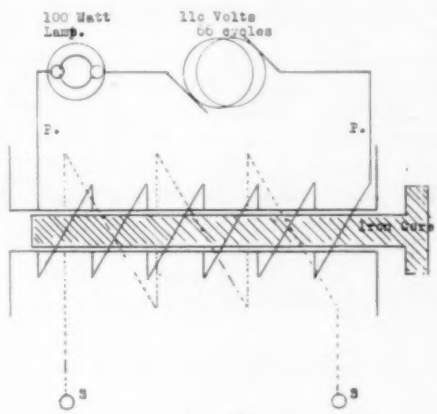


Fig. 70.

burning. When we connected the ends of the new coil or secondary, the lamp burned again, and yet the iron core is still in place. Therefore some action in the coil must have overcome the magnetic opposition.

In Fig. 71 we show two coils wound on a soft iron circle. The one coil we call "P," or primary, and the other "S," or secondary. If a current is passed through "P" it will set up a magnetic field. This magnetic field will seek the lowest resistance path, which will be around the iron circle. But this takes it through the winding of "S" and also through the winding of "P." Now any magnetic field in motion will induce a current in the coils surrounding it. Therefore there will be a current induced in "P" in a direction opposite to the incoming current. Therefore there will be the incoming voltage, opposed by the induced voltage, which flows in the opposite direction, and out through the lamp and generator. If the two opposing voltages are equal, or nearly so, then the lamp will not burn.

There will be no flow in coil "S" as long as the coil is not connected. But when the ends of coil "S" are connected, the magnetic flow set up by "P" will induce a current in the coil "S." This current will flow in a direction opposite to the incoming current from the generator. If current flowing in "S" is opposite in direction to the incoming current in "P," then any magnetic effect it would have would be opposite to any magnetic effect of the incoming current in "P." If there is a current flowing in "S" then it must set up a magnetic field in the core of the coils. If this magnetic field flowing in the same core, and in the opposite direction to the magnetic field set up by "P" is the same strength as that field, then the one magnetic flow will overcome or neutralize the other. Therefore there would be no magnetic effect since one

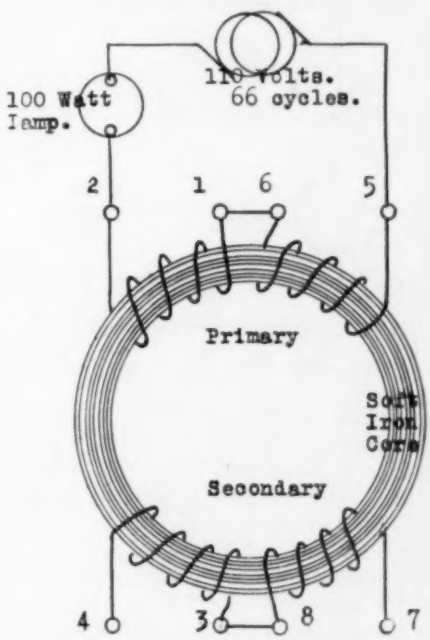


Fig. 71.

overcomes the other. If there is no magnetic effect, then the inductance of the coil will be lowered, and consequently the impedance of the primary will be lowered to the incoming current. If the impedance is lowered, the lamp should light again. This is what actually takes place.

The strength of the flow of the induced current in "S" will depend on the amount of resistance in the circuit through which it flows. Therefore if

there is only a small current flowing in "S," its magnetic power would also be small, and therefore it would not entirely overcome the magnetic effect of the coil "P." The impedance of "P" would be lowered then only to the extent of the flow of the current in coil "S." The flow of current in the primary will depend on the flow or the load on the secondary.

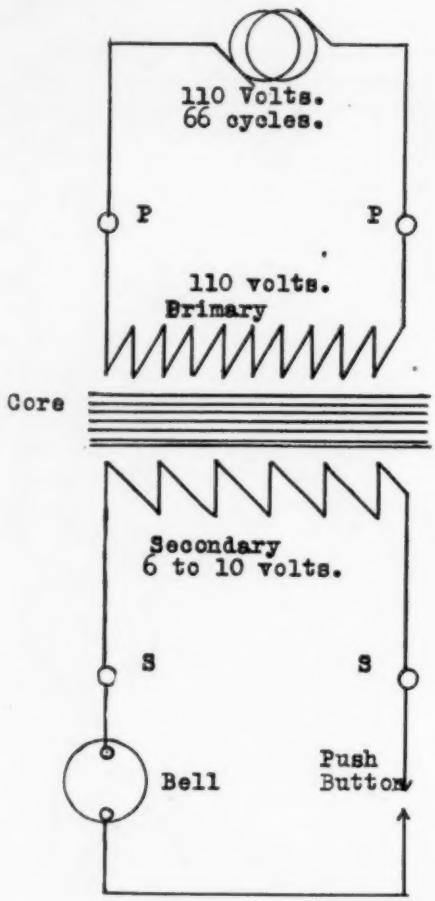


Fig. 72.

In Fig. 72 is shown a bell ringing transformer. The primary of this transformer is wound with many turns of fine wire. The secondary is wound with a few turns of coarse wire. This is a step down transformer. When the push button is open then there is no current flow in the secondary. In this condition the impedance of the primary is so high that there will be no indication in the meters of any current consumption. When the bell rings, the impedance of the primary is lowered and the meter will indicate a flow of current in the primary.

formers are usually wound on an iron circle made up of a bundle of soft iron wires. They usually consist of two equal windings on each half of the ring, in all four windings. Connect the four windings in series as in Fig. 73, and the impedance is very high. This can be proven by connecting the oscillator and receiver in series with the coil as shown.

In Fig. 74 the receiver and the tone

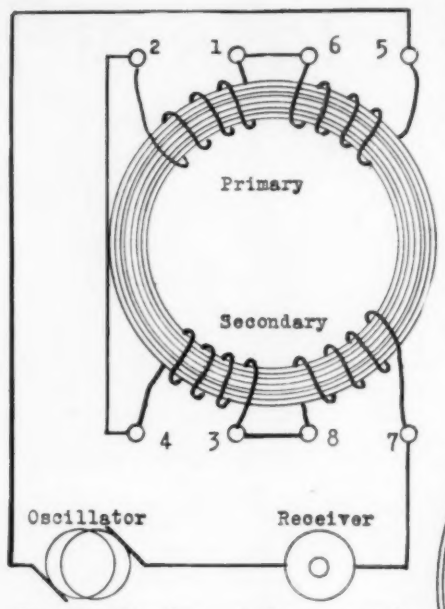


Fig. 73. Showing telephone repeating coil used as impedance coil.

are connected in series with the primary of the repeating coil. Observe the loud-

Telephone repeating coils or transtone is very high, with the secondary open, while it is low as indicated by the loud tone, when the secondary terminals are connected.

In Fig. 75 the tone is connected to the primary and the receiver to the secondary. Here the tone is just as loud as

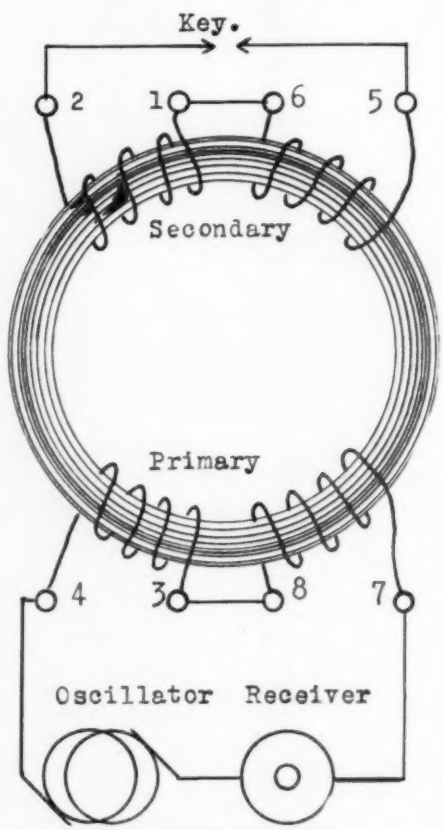


Fig. 74. Showing effect on primary of open and closed secondary winding. Using high frequency.

it would be if connected to the oscillator alone.

Telephone transformers are designed to ness of the tone with the secondary terminals open and then connected together. The impedance of the primary to the

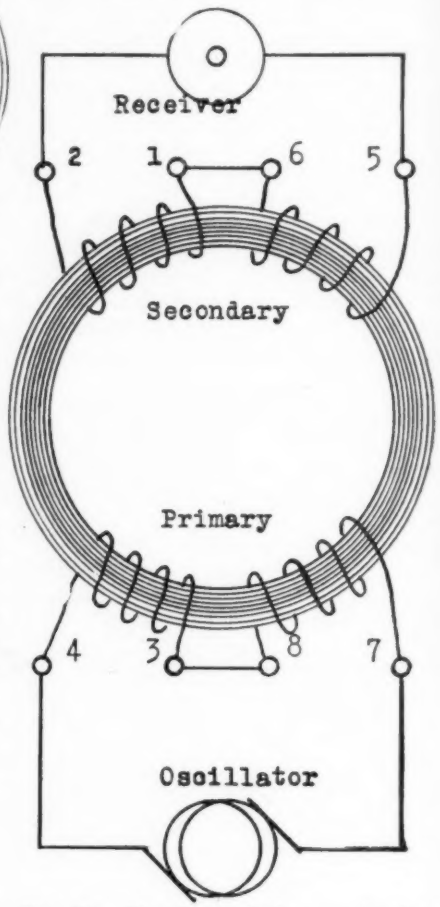


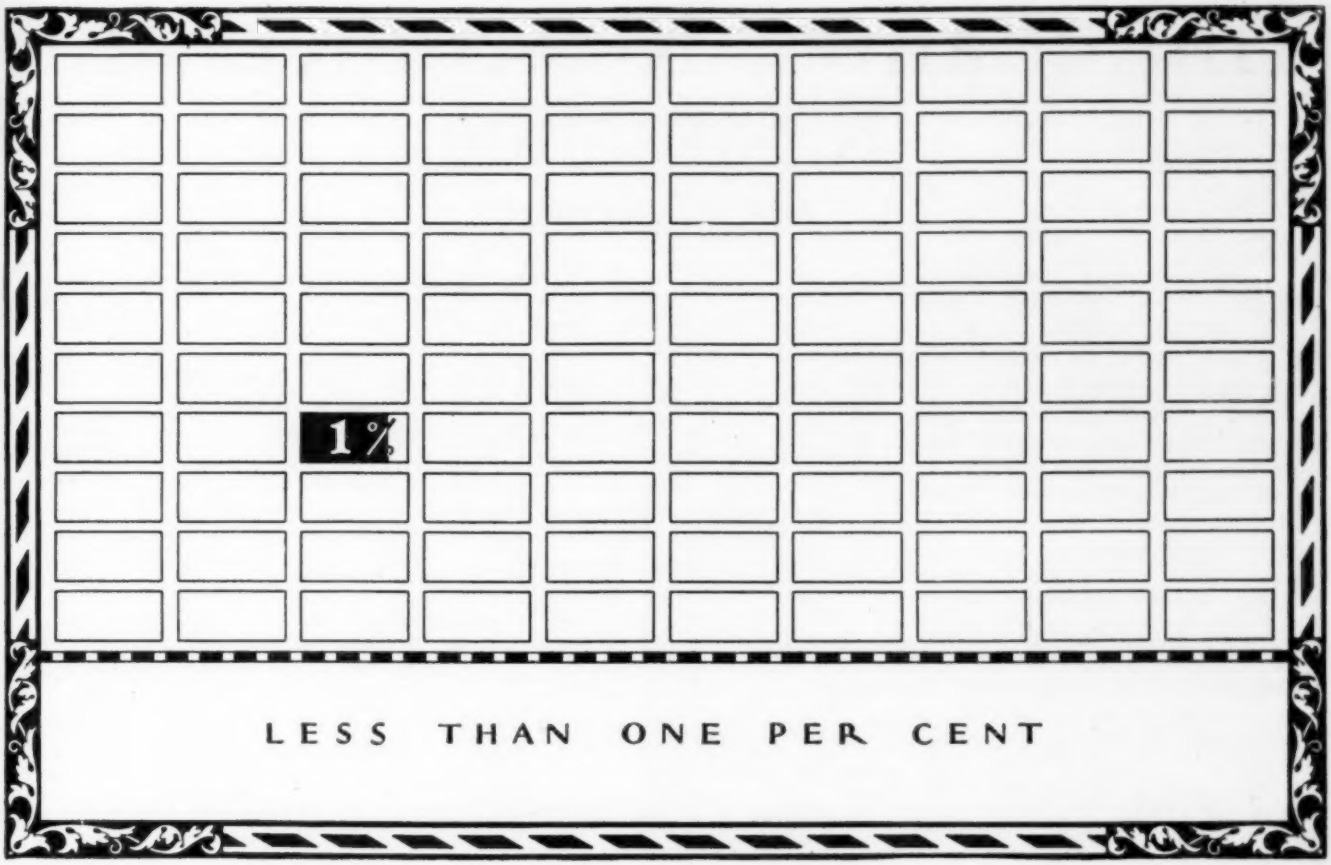
Fig. 75. Showing telephone repeating coil as connected in a line to talk through.

The bell ringing transformer is a step down transformer, and the induction coil is a step up transformer. Repeating coils are mounted with metal shields over the coils. This permits them to be placed close together, without any interaction between them.

In the next chapter we will discuss some line circuit arrangements and cord pass the voice frequencies with great efficiency. They are also designed to pass equally in either direction. Therefore they can be called straight ratio transformers. circuits, as used in magneto systems.

M. A. Reed, Former Iowa, President, Dies

Woodbine, Ia.—M. A. Reed, president and general manager of the Boyer Valley Telephone Co., died suddenly at his home here Nov. 4. He was a pioneer of 31 years' standing in the telephone industry and severed a year ago as president of the Iowa Independent Telephone Association. He was prominent in financial and civic affairs in Woodbine.



An Advertisement of
the American Telephone and Telegraph Company

No one person owns as much as 1% of the capital stock of the American Telephone and Telegraph Company.

The company is owned by more than 420,000 people, with stockholders in every section of the United States. It, in turn, owns 91% of the common stock of the operating companies of the Bell System which give telephone service in every state in the Union, making a national service nationally owned.

The men and women owners of the American Telephone and Telegraph Company are the largest single body of stockholders in the world and they represent every vital activity in the nation's life, from laborer and unskilled worker to wealthy and influential executive. Although the telephone was one of the greatest inventions of an age of large fortunes, no one ever made a large fortune from it—in fact, there are not any "telephone fortunes." The Bell Telephone System is owned by the American people. It is operated in the interest of the telephone users.

Impedance, Reactance and Resonance*

By F. J. DOMMERQUE
Fellow A. I. E. E.

86. Alternating Current Circuits Containing Resistance Only

In reality there are no alternating current circuits entirely free from inductances and capacity, but for sake of discussion it may be assumed that the inductance and capacity in the circuit is so small that it may be neglected. If a sine wave alternating e. m. f. is applied to such a circuit, this e. m. f. can be expressed by the equation $y = A \sin \frac{2\pi t}{T}$, wherein y is the value of the function at any instant, or as we may put it, the *instantaneous* value of the function, and A the *maximum* value of the same function, t the time, T the periodic time, $\frac{1}{T}$ or n the frequency, $w = \frac{2\pi}{T}$ the pulsation.

The instantaneous e. m. f. is denoted most frequently by e, and the maximum e. m. f. by E_{max} or E_m. Thus the above equation may be written as $e = E_m \sin wt$.

To find an expression for the *instantaneous current*, it must be remembered that a current flows, whenever the e. m. f. overcomes the ohmic resistance r; hence $i = \frac{e}{r} = \frac{E_m}{r} \sin wt$.

e and i, just found, are not the equivalents of the continuous electromotive force and current; the corresponding values for alternating electromotive force and current, which are termed the *effective* values, are found by the following method:

The inspection of a sine curve for one period plainly shows that the two halves of the curve are of equal area, but of opposite location, or rather of opposite sign. Thus a summation of the area embraced by one complete period would result in zero, and as an *average* value of the ordinates of a curve is found by adding the ordinates and dividing the sum by the number of ordinates, the average value of the sine curve would be zero. It must be stated, however, that the part of the curve below the time line does not mean that half the *magnitude* of the e. m. f. is negative, but that the *direction* only is negative. Hence an average value of the e. m. f. or current is found by adding the two parts of the area enclosed by the sine curve and time line, and dividing the sum by the number of abscissae. But we have twice the same amplitude during one period, and to express the average value in terms of maximum value, we need only to sum over one-half of a period and divide by the number of abscissae for one-half of a period. Such a summation of an area is mathematically designated by integration. Integrating, however, belongs in the realm of higher mathematics, then the mathematics we intend to apply; therefore we will rest content with stating the results, which are that the average value obtained is equal to $\frac{2A}{\pi}$ or $0.6369A$; whence $e_{ave} = 0.6369E_m$ and $i_{ave} = 0.6369 \frac{E_m}{r}$.

Although it is often useful to know the average value, of more importance is the effective value of e. m. f. and current, in fact, most of the discussions of alternating currents, when simply voltage and current is spoken of, the effective voltage and effective current is intended.

By multiplying the two average values found above with each other we obtain the average or mean power developed in an alternating current circuit. Thus it should be: Mean power $= 0.6369^2 \frac{E_m^2}{r} = 0.40564 \frac{E^2_m}{r}$.

In order to investigate the true watts* in an alternating current circuit, plot in Fig. 100 two curves, one for the e. m. f.

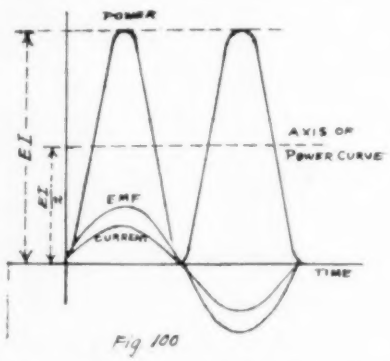


Fig 100

and one for the current. The current curve will be the lower one, as there is some resistance in every circuit. As we are taking into account for the present only resistance in the circuit, there will be no phase difference between the two curves. Now multiply the current ordinate by the e. m. f. ordinate corresponding to every instant of time from zero to half period. Every product thus formed will be an ordinate of the power curve corresponding to the instant for which the product e i was taken and the assemblage of all these products will give the power curve itself. Observe that the power curve remains on the positive side of the time line through the entire period, which is correct, for the product of two negative quantities is positive. Integrating the area between power curve and time line over the whole period and dividing by the number of abscissae gives the true watts. We refrain from going through the process of integration for the reason mentioned, and give the result, namely: true watts $= \frac{E^2_m}{2r}$.

We have found a positive value for the ordinate of the power curve over the whole period. The e. m. f. ordinates and current ordinates can also be expressed by positive values, when we consider that the square of a negative quantity is positive; hence designating the effective e. m. f. and the effective current by the *square root of the mean square* values, we obtain, using the abbreviation r. m. s. for √ mean square, r. m. s. volts × r. m. s. amperes $= \frac{E^2_m}{2r}$.

As $I_m = \frac{E_m}{r}$ we can write for $\frac{E^2_m}{2r}$ also $\frac{E_m}{\sqrt{2}} \times \frac{I_m}{\sqrt{2}}$ or $0.707\ E_m \times 0.707\ I_m$.

Thus the effective e. m. f. $= \frac{1}{\sqrt{2}}$ or 0.707 maximum e. m. f., and the effective current $= \frac{1}{\sqrt{2}}$ or 0.707 maximum current.

A dynamometer measures the r. m. s. or effective values in non-inductive circuits.

87. Circuits Containing Resistance and Inductance

Alternating currents by changing their direction and intensity create extra currents in their paths, which again give rise to a counter e. m. f., hence with the same external e. m. f. the current is diminished, and it has the appearance that the alternating current circuit possesses a greater resistance than a con-

Twentieth article on Telephone Mathematics and Physics.

*True watts is the actual power available as measured by a wattmeter.

tinuous current circuit, wherefor the resistance of an alternating current circuit is often called the appearant resistance.

The ratio between the e. m. f. of the extra current and the time rate of change of the current is the *inductance* of the circuit. A current changing at the rate of 1 ampere per second, and generating thereby an e. m. f. of 1 volt has an inductance = 1 henry. This e. m. f. of inductance is displaced by 90° from the original current. Designating same by e_{ind}, we have $e_{ind} = Li\frac{2\pi}{T}$, where L is the inductance. As a unit of current generates a magnetic field of force = L, the current i will generate Li lines of force, which come and go with the angular velocity $\frac{2\pi}{T} = w = 2\pi n$; whence $e_{ind} = 2\pi nLi$.

The e. m. f. to overcome the ohmic resistance r or the *active* e. m. f. is in phase with the current. The e. m. f. of inductance lags 90° behind the current and the e. m. f. to overcome this counter e. m. f. of inductance is the *reactive* e. m. f., which is 90° ahead of the current. The *active* e. m. f. plus *reactive* e. m. f. is the *impressed* e. m. f. The active e. m. f. is e = ri and as the reactive e. m. f. $e_{ind} = 2\pi nLi$ is 90° ahead of the current we can not simply add them to obtain the impressed e. m. f. but must determine the latter as the resultant of the active

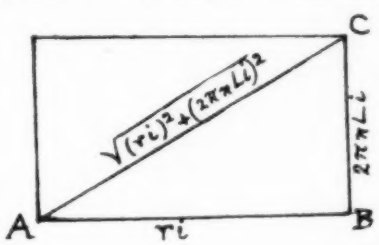


Fig. 101

and reactive e. m. f. by application of the parallelogram of forces.

In Fig. 101 make AB = ri and at right angle to it lay off BC = 2πnLi using the same scale. Draw through A a line parallel and equal to BC, and through C a line parallel and equal to AB as indicated in the figure, then the line AC will represent the resultant impressed e. m. f. To express this resultant, we remember the Pythagorean Theorem explained in section 27, which relates that in a right triangle the square of the hypotenuse equals the sum of the squares of the two sides; hence, as the sum of the squares of the two sides is $(ri)^2+(2\pi nLi)^2$, the resultant will be $\sqrt{(ri)^2+(2\pi nLi)^2}$.

In most practical cases the ohmic and the inductance resistance are given, namely r and 2πnL, respectively, and the resultant resistance is to be found as $\sqrt{r^2+(2\pi nL)^2}$. This value is called the *"impedance,"* while the resistance 2πnL is called the *"reactance."* Consequently: impedance = $\sqrt{\text{resistance}^2+\text{reactance}^2}$. The reactance of an alternating circuit containing resistance and inductance is usually expressed as wL. It has become customary to denote the impedance by the letter Z.

88. Circuits Containing a Condenser and Resistance

In alternating current power transmission, as a rule, currents are carried over long distances at higher tension than in continuous current transmission. Therefore, the line insulation must be more perfect as to every effective alternating current pressure of one volt corresponds a maximum pressure of $\frac{1}{0.707}$ or 1,4142 volts; thus the alternating current transmission line must have a 1.4142 times better insulation, everything else being equal, than a continuous current transmission line.

In a telephone line over which feeble currents of comparatively low pressure are transmitted but with very high frequencies the long overhead lines and cable lines ring in capacity, the effect of which cannot be neglected.

In a continuous current circuit a condenser acts as a reservoir for storing electricity, it collects the whole charge of the circuit until the potential at the terminals of the condenser equals the potential of the source of supply; then the current ceases to flow and the product of potential into the charge represents the energy stored in the condenser, namely Q = C × V, where Q is the quantity of electricity or charge, C is the capacity and V the difference of potential between the plates of the condenser.

Whenever the source of the e. m. f sends a variable current through the circuit containing the condenser, a charging and discharging of the condenser takes place, for, whenever the difference of potential at the terminals of the condenser is a maximum, the charging current must be zero and in the next instant the condenser begins to discharge, sending out a current growing with the change in difference of potential.

Let the maximum current in an alternating current circuit be i, then $i = \frac{2\pi}{T} C \times e_{cap}$, where e_{cap} is the capacity e. m. f., hence $e_{cap} = \frac{iT}{2\pi C} = \frac{i}{wC}$ leading current by 90°.

Thus where with inductance the e. m. f. of inductance $e_{ind} = iwL$ lagged 90° behind the current, here $e_{cap} = \frac{i}{wC}$ is 90° in advance of the current.

In Fig. 102 is presented a diagram of construction of the impressed pressure in a circuit containing capacity and resistance on similar lines as the impressed pressure was constructed in Fig. 101 for a circuit containing inductance and

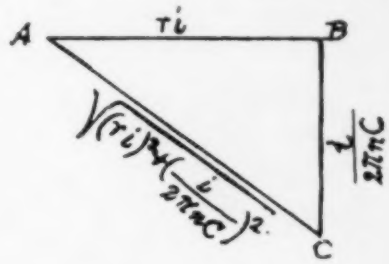


Fig 102

capacity. It will be noticed that the reactive e. m. f. is drawn in the opposite direction in Fig. 102 from that in Fig. 101; this is done because in the capacity case the pressure is 90° behind the current. Correspondingly the reactance of a condenser circuit, that is the capacity reactance = $-\frac{1}{wC}$ and the capacity impedance =

$$\sqrt{r^2+\left(\frac{1}{2\pi nC}\right)^2} \text{ or}$$

$$\sqrt{r^2+\left(\frac{1}{wC}\right)^2}$$

89. Circuits Containing Inductance, Capacity and Resistance

It is supposed that inductances, capacity and resistance is connected in series in the circuit, then the impedance will be obtained by constructing the resultant inductance and capacity first and combining this resultant with the resistance by the parallelogram of forces. In Fig. 103

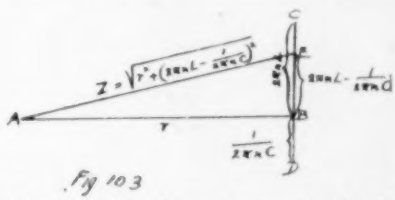


Fig 103

BC is the inductive reactance 2πnL, BD the capacity reactance $-\frac{1}{wC}$ and AB the resistance, with the assumption that the inductance reactance is larger than the capacity reactance. If the capacity reactance would be larger than the inductance reactance, the sign of the resultant inductance and capacity reactance would be negative, but as the reactance is squared to obtain the impedance, the sign will be positive.

Thus we find the impressed e. m. f. as $e_{imp} =$

$$\sqrt{r^2i^2+\left(2\pi nLi-\frac{i}{2\pi nC}\right)^2}$$

and the current as

$$\frac{e_{imp}}{\sqrt{r^2+\left(2\pi nLi-\frac{1}{2\pi nC}\right)^2}}$$

90. Resonance

If in the above expressions for e_{imp} and current L is made equal to $\frac{1}{(2\pi n)^2C}$, these expressions will reduce to $e_{imp}=ri$ and $i=\frac{e_{imp}}{r}$, that is, inductance and capacity will neutralize each other. Thus, when in a circuit containing inductance and capacity, the reactance of the condenser is exactly equal and opposite to the reactance due to inductance, so called *Resonance* is obtained. The condition for resonance can also be expressed as

$2\pi n$ or $w=\frac{1}{\sqrt{LC}}$ or, w being $=\frac{2\pi}{T}$,

as $\frac{1}{T}=\frac{1}{2\pi\sqrt{LC}}$ or $T=2\pi\sqrt{LC}$.

Suppose in the equation $e_{imp}=\sqrt{r^2i^2+\left(2\pi nLi-\frac{i}{2\pi nC}\right)^2}$

the resistance r to be very small and the frequency such as to make $T=2\pi\sqrt{LC}$, then the current will be large. If the frequency is such as to make $T>2\pi\sqrt{LC}$, then $2\pi nL$ will be greater than $\frac{1}{2\pi nC}$ and the lagging current will be choked by the inductance; on the other hand, if the frequency is such as to make $T<2\pi\sqrt{LC}$, then the capacity reactance will overbalance and the leading current be choked.

Whatever the arrangement of resistance, inductance and capacity in a circuit may be, the resonance condition $L=\frac{1}{(2\pi n)^2C}=\frac{1}{w^2C}$ or $C=\frac{1}{(2\pi n)^2L}=\frac{1}{w^2L}$ suggests that any capacity may be considered as a *negative* inductance, which produces a current in advance of the e. m. f., instead of a lagging current. Thus, by substituting for the capacity C or corresponding negative inductance $L=-\frac{1}{w^2C}$, all problems may be solved, whether resistance, inductance and capacity are arranged in series or parallel.

If it is desired to determine the frequency at which resonance is obtained we use the equation $2\pi n^2L=\frac{1}{2\pi C}$, which is a simple transformation of the formula for resonance condition $L=\frac{1}{(2\pi n)^2C}$.

From $2\pi n^2L=\frac{1}{2\pi C}$ we determine

$$n^2=\frac{1}{(2\pi)^2LC}=\left(\frac{1}{2\pi}\right)^2\times\frac{1}{LC}$$

whence $n=\frac{1}{2\pi}\sqrt{\frac{1}{LC}}$, which is the resonance frequency.

If we place n condensers having each a frequency of C microfarad in series, the total capacity will amount to $\frac{C}{n}$ m. f. If the n condensers are placed in parallel, their total capacity will be $c\times n$ m. f.

MAKES TALK PLAINER, SAY BRITISH

—Photo International Newsreel.

Photo shows a new type of telephone exhibited at the British Shipping and Engineering Exposition. The speaker fixes the mouthpiece not in front of his mouth, but as tightly as possible to his neck. Sound is produced by mechanical and not by air waves.

American Electric New Catalog Valued Buyers' Guide

Chicago, Ill.—American Electric Co., Inc., has issued a new catalog on telephone construction material and supplies that is one of the most complete and practical volumes of its kind for the telephone man. Editing of the catalog is a splendidly done job for there is in evidence the data that will help a telephone man to make a good and definite decision regarding the fitness of the supplies listed for his requirements.

The book is profusely illustrated and the material is presented in such shape that ready reference is one of the volume's many practical features. The new American Electric Co., Inc., catalog is handsomely and durably bound so it should keep its good looks despite the frequent use to which it will be subjected.

Sumner, Ia.—C. R. Hurmence has been appointed general manager of the Iowa State Telo. Co.

General Carty Awarded 1926 John Fritz Medal

New York City—The John Fritz Gold Medal for 1928 was awarded to General John J. Carty, of New York, for achievement in telephone engineering. This annual award was made unanimously by the Board of sixteen representatives of the American Societies of Civil, Mining and Metallurgical, Mechanical and Electrical Engineers, having an aggregate membership of 57,000.

This medal is awarded not oftener than once a year for notable scientific or industrial achievement, without restriction on account of nationality or sex. It is a memorial to John Fritz, late of Bethlehem, Pennsylvania, long a leader in the American iron and steel industry.

This is the 24th award; the first was to John Fritz in 1902 in celebration of his eightieth birthday.

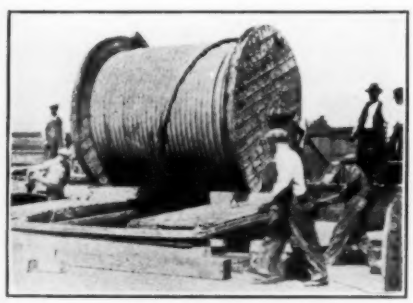
The presentation of the medal will take place in February, 1928, in connection with the Annual Meetings of the American Institute of Electrical Engineers, in the Engineering Auditorium, 29 West 39th street, New York.

LINE AND DESK

U. S. AND CANADA LINKED BY NEW CABLE

The laying of a new cable across the Detroit River between Detroit and Windsor, Ontario, was not only an interesting engineering achievement but is also an indication of the growth of telephone service between this country and its northern neighbor. The new cable described by Cal Patterson in the October number of *The Mouthpiece*, contains 530 pairs of wires and cover a total distance of approximately 10,430 feet between the Cadillac office of The Michigan Bell Tel. Co. and the Seneca office of the Bell Tel. Co. of Canada. Of that distance 2,900 feet of submarine cable traverses the bottom of the Detroit river. The new cable is three and eight-tenths inches in diameter. Without the protecting armor, it is slightly more than two and a half inches through.

The other two submarines in use between Detroit and Windsor have a total of 476 pairs of wires, while the new cable contains more than two together, or 530 pairs, of which 519 have been placed in service. The remaining circuits are reserved for emergency use. The new cable also contains quads, giving it a capacity of 35 additional or phantom circuits and making a total of 565 simultaneous conversations possible.



UNLOADING THE BIG SPOOL

Sixty-eight thousand pounds of submarine cable for use between Detroit and Windsor, were wound about this big reel, which took no small amount of clever engineering and perspiration to unload from the gondola.

The first cable between Detroit and Windsor consisting of three circuits was laid in 1880 and a five-conductor cable replaced it a few years later. In 1905 a 30-pair cable was placed and in 1908, a second 30-pair cable was added.

In 1919 a quadded cable of 68 pairs was laid and in 1921 a much larger cable of 408 pairs was placed.

Four permits for laying each submarine cable across the international boundary at Detroit are required. In the laying of the new cable, the Company secured a permit signed by the president of the United States, a War department permit and a City of Detroit permit. In Canada, the project was passed upon by a committee of the privy council and was approved by the governor-general. The archives of the Michigan Bell Company contain permits for such cables signed by Presidents Woodrow Wilson, Warren G. Harding and Calvin Coolidge.

Traffic records show that more than 10,000 telephone conversations are carried each day to Canada and eastern points of the United States through the Detroit-Windsor cables, while slightly less than that number originate in Canada and are brought to the United States by this route.

Manpower was required to "figure-eight" this cable on a scow preparatory to laying between Detroit and Windsor

---

"STEP ON HER"

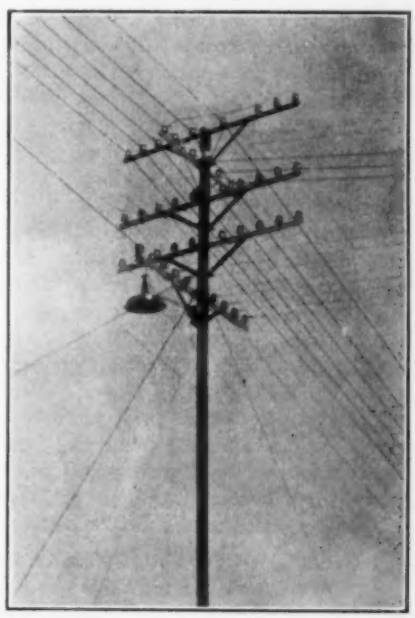
Step on her! Give her the gas! Sure it's exciting and all that sort of thing, but do the brakes slow up your car as quickly as you speed up when you "step on her?" Will those tires, which you have had on since you bought the car, stand the strain, or will they burst?

Of course, you inspected those brakes. (Let's see when was it), and you know there is no chance of the steering mechanism breaking (or do you) and then how desires to hit sixty or seventy miles an hour whenever they see a hundred yards of space to drive on.

about the other fellow coming down that side street, who is also "giving her the gas."

Crepe-hanger, you say. Yes, I know, but speed laws are designed for our safety because there are always some folks who must have a check on their

So, if you and I, who always obey the speed laws for our own safety, will keep up the good example, perhaps others will notice it and fall in line, and all of us will "get to the place we're goin' at"



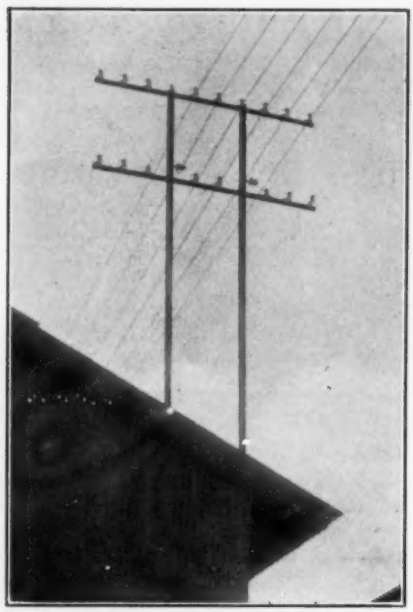
A 54-lb. steel rail distribution pole in Central America

in plenty of time and without wrecked nerves, broken bodies, or shattered cars. —*Paul Bauer in Bell Telephone News.*

SOME ODD H FIXTURES

Our call for help and the subsequent discussion of H fixtures brought a reply with some interesting information from E. D. Nuttall, chief electrician, of the International Railways of Central America, San Salvador, El Salvador. Mr. Nuttall writes as follows:

"I enclose a picture of an "H" Fixture that I am using on the north end of the power plant. The height of the fixture is 14 feet above roof of power plant. The top cross arm of the fixture is 42 feet above the ground. The fixture



An "H" fixture in San Salvador

is made up of 2½ inch x 2½ inch angle iron, the cross arms are 8 feet 3 inches long. The upper arm carries power and lighting wires, 220 volt 3-phase power, 220/110 volt lighting. The lower arm carries telephone and telegraph wires. The cross arms are also 2½ inch x 2½ inch angle iron."

"I also enclose a picture of a 54-lb. steel rail distribution pole. It is the first pole north of the "H" fixture and is also 42 feet high. I believe it to be one of the heaviest loaded steel rail distribution poles, for its height, in Central America."

"To get back to 'H' fixtures. I have used a 'rig' similar to the enclosed picture, over in the banana country of Honduras, on several different occasions, to carry wires over railway water tanks."

FINES DISCOURAGE TEXAS GLASS HUNTERS

Telephone companies have had more or less trouble in the past with a class of people who take delight in breaking glass insulators by shooting at them or throwing rocks. This kind of so-called sport has cost the telephone companies a lot of money.

It might be of interest to our members to know that such persons creating misdemeanors of this kind have been arrested, brought to trial and heavily fined. Recently it cost a young "sport" in East Texas the nice sum of $136.50 for shooting off a few glass insulators on a telegraph line. Two other cases cost the boys who broke the insulators $25.00 each and the costs.

We suggest that this information be given publicity in your community, especially if you are troubled in this way. If you have much loss it would be well to catch one of the culprits, bring him to trial and in this way set an example for others who like to see the bright, shiny insulators pop.—*Texas Independent Bulletin.*

ARKANSAS MEETING AT LITTLE ROCK, JAN. 16-17

Little Rock, Ark.—The Arkansas Telephone Association will hold its annual convention at the Hotel Marion, Little Rock, January 16th and 17th, 1928.

Why get used to those little leaks of profits?

WHEN we can get managers to get down to brass-tacks in checking cord costs, then it's easy to make Runzel-Lenz cord sales. We can show comparative tests in actual service and exclusive cord construction features that convince the big majority of those who go deeply into the cord situation.

Is there any reason why you should keep on thinking that cord troubles, like the poor, are going to exist forever? It's costing you money to take cord troubles for granted.

Just give a few Runzel-Lenz cord tests and let their superior materials and advanced design and workmanship prove they can save money and annoyance for you.

It's easy to do. Take some action by writing us now regarding the Runzel-Lenz cords for your requirements.

Runzel-Lenz Electric Mfg. Co.

Specialists in the Making of Superior Telephone Cords

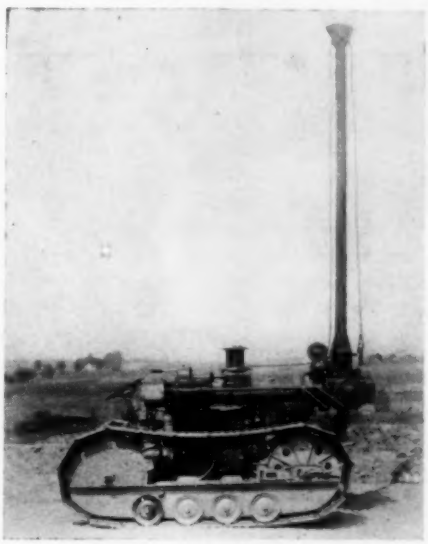
1751 N. Western Ave. Chicago, Ill.

Highway Earth Boring Machine Makes Good

Edgerton, Wis.—The Highway Earth Boring Machine manufactured by the Highway Trailer Co. is fast creating genuine interest among telephone companies, electric light and power companies and various other organizations who may have use for an earth boring tool.

The Highway Trailer Co. has for many years past, enjoyed the distinction of being the largest builders of earth boring equipment and its new machine is the result of years of effort to perfect an earth boring tool to meet every requirement and solve the hole digging and pole setting problems in line construction and maintenance work.

The boring unit, which is very similar to the larger machine that the Highway Trailer Co. has always built for the American T. and T. Co., is a finished product rich in both the selection of material and workmanship. It is powered by the reliable and easily serviced Fordson motor and the entire unit is so mounted on a crawler type track that it maneuvers with ease and rapidity. Included in its mounting is a 2,500 pound capstan and a neat and durable one-piece boom or pole derrick rising from 14 to



Highway trailer's borer is compact, sturdy outfit

18 feet above the ground in working position or dropped to 8 feet from the ground for road travel.

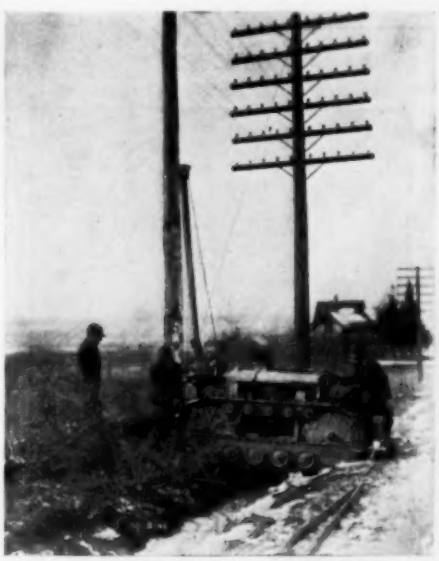
The flexibility of this new Highway Earth Boring Machine is one of its outstanding features. It is capable of digging a hole 7 feet deep, 20 inches in diameter and at an angle of 45 degrees at right angles to or with the machine. Its ability to easily negotiate nearly every piece of terrain and to operate on steep banks or in ditches has won no little favorable comment. With the track transmitting less than 4 pounds road pressure to the square inch, marshes and swamp conditions are no barrier and the machine has been known to traverse and operate in such conditions where it would be impossible for a man to go on foot.

In average terrain and soil conditions, this new Highway Earth Boring Machine will easily dig holes for and set from 50 to 60 poles a day. In the first time test ten holes were drilled and ten poles set in the ground in 55 minutes. More recently a large public service company has reported that in actual line construction work they were able, with the aid of this machine, to dig the holes for and set 12 poles in one hour or an amazing average of a pole in the ground every five minutes.

The utility companies now using the

Pole setting jobs are handled nicely

Highway Earth Boring Machine substantiate the Highway Trailer Company's claim that this new machine will reach



One man operation is easy on boring jobs

98 per cent of the locations, dig in almost any soil conditions and at such a great saving per hole as to pay for the machine in a remarkably short time.

Curran New Outside Plant Canadian Bell Boss

Montreal, Can.—W. H. Curran, for 20 years associated with the Bell organization has been made outside plant engineer of the Bell Telephone Co. He entered telephone service with the Pacific T. & T. Co. and following the war, during which he served as major in the Signal Corps, went with the Central Union. In 1925, he was appointed plant engineer for the Indiana Bell.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

of Telephone Engineer, published monthly at Chicago, Ill., for October 1, 1927.

State of Illinois, County of Cook, ss.—Before me, a notary public in and for the state and county aforesaid, personally appeared W. H. Graffis, who, having been duly sworn according to law, deposes and says that he is the business manager of Telephone Engineer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to-wit:

1. That the names and addresses of the publisher, editor, general manager and business manager are:

Publisher — Wm. H. Graffis & Sons, 236 N. Clark St., Chicago, Ill.

Editor—Herbert Graffis, Chicago, Ill.

Business Manager—W. H. Graffis, Chicago, Ill.

Advertising Manager — Jos. M. Graffis, Chicago, Ill.

2. That the owners are (give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock):

W. H. Graffis, Herbert Graffis and Jos. M. Graffis, all of 236 N. Clark St., Chicago, Ill.

3. That the known bondholders, mortgagees and other security holders owning or holding 1 per cent of more of total amount of bonds, mortgages or other securities are (if there are none, so state) —None.

4. That the two paragraphs next above, giving the names of the owners, stockholders and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder of security holder appears upon the books of the company as trustees or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any person, association or corporation has any interest, direct or indirect, in the said stock, bonds or other securities than as so stated by him

5. That the average number of copies of each issue of this publication sold or distributed through the mails or otherwise to paid subscribers during the six months preceding the date above is..... (This information is required from daily publications only.)

TELEPHONE ENGINEER,
W. H. Graffis, Bus. Mgr.

Sworn to and subscribed before me this 31st day of October, 1927.

(Seal) NELL J. ROSE.

(My commission expires March 2, 1933.)

U. S. I. T. A. Directors Review Work

Chicago, Ill.—Directors of the United States Independent Telephone association, after re-electing the associations officers and directors reviewed the activities of the year with particular reference to the Independent and Bell relations, the I. C. C. hearing on depreciation and the organization membership and financial developments.

The directors recommended the conventions' adoption of a resolution defining qualifications for membership in the association more strictly so members would adhere to approved standards of practice. The action was taken to safeguard the industry against improper consolidations and sales.

W. R. McCanne, president and general manager of the Stromberg-Carlson Telo. Mfg. Co., whose resignation as a director was submitted, due to his many other duties, was prevailed upon to withdraw his resignation and continue his labors as a member of the executive board.

Georgetown, Tex.—E. P. Seaman has been named district manager of the Southwest Telephone Co. here.

New Hotel Eitel
Chicago
The Next Time You Come
to Chicago make your visit a splendid success by stopping at this beautiful new hostelry.
Room and Bath, 1 person —$3.50, $4, $4.50, $5
Each additional person, only $1
Room and Bath, twin beds—$6, $7, $8
Under the personal supervision of ROBERT J. EITEL and MAX EITEL
Delaware Place at Rush St.
Just a few blocks from the Loop

Celebrate Harry Eldridge's 20th Bell Year

Chicago, Ill.—Harry Eldridge, division commercial manager, suburban division, observed his twentieth anniversary with the company October 1. Harry started as service inspector in the suburban traffic department and has kept on climbing.

A small but enthusiastic gathering at a loop broncho restaurant assembled to celebrated Harry's anniversary listened to the following ode of appreciation:

Who listens to the eager pleas,
Of phone trade papers' employes,
And handles all our woes with ease?
Harry Eldridge.

When buddies come to us and moan
"We simply have to have a phone,
"Do you know some bird whose heart
ain't stone?"
We answer, "Harry Eldridge."

He makes his job a lot of fun
And always seems to get things done,
So we are very strong for one.
Harry Eldridge.

GRACE TELLS TELEPHONE'S "ARABIAN NIGHTS"

(*Continued from page* 21)

phone. By the use of a Vitaphone reproducer, Mr. Grace was able to reproduce the effect of the old type phonograph record for comparison with the new records and the restricted frequency ranges of the older records were immediately evident when the same music was played from one of the records made by the electrical reproduction method.

Radio Secrecy Attained

The speaker then proceeded to a demonstration that was one of the most spectacular and interesting of the lecture. One of the problems of secrecy in radio telephone transmission has been attacked by the use of a frequency inversion scheme. By this method, the low frequencies of the voice are transmitted as high frequencies and the high frequencies of the voice are transmitted as low frequencies. This results in a synthetic language which to the ordinary listener sounds like an unintelligible gibberish. Translated by an "electrical brain" it again becomes ordinary speech. Records of the inverted speech were reproduced by the use of the loud speaker system of the Hotel Sherman and the Vitaphone reproducer. It is said that men working with the system become accustomed to the speech and can understand it to some degree. Mr. Grace showed his proficiency in the new language by speaking two words which sounded to the reporter something like "Seekah-dah, On-yo-nee-ah." After repeating them several times, he spoke them into the mouthpiece of a microphone connected to the translating system and the loud speaker and the words "Chicago, Illinois" were very clearly heard by the audience. Mr. Grace then spoke of other investigations being conducted at the laboratories and concluded the lecture by quoting the lines of an original poem which he has named "The Creed of the Research Man."

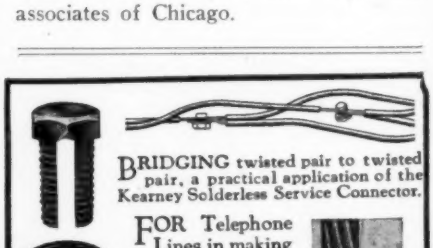
Lockwood, Mo.—Local telephone plant bought by Commonwealth Telo. Co.

Winchester, W. Va.—South Branch Telo. Co. bought by Grinnell Wylie and associates of Chicago.

MAGNETO DESK SETS

Western Elec. Co. 1020-AL desk stands with 315 type magneto bell boxes, 2 or 3 bar, 1000, 1600 or 2500 ohm ringers (completely refinished $10.50
Kellogg No. 28 or No. 84 magneto desk sets,
3 bar 1000 ohm..... 9.00
4 bar 1600 ohm..... 9.50
Dean Elec. Co. 3 or 4 bar desk sets..... 7.50
Chicago Tele. Co. 4 or 5 bar desk sets..... 7.50
Leich Electric Co. 4 or 5 bar sets..... 9.00

Buckeye Telephone & Supply Company
Columbus - - Ohio



BRIDGING twisted pair to twisted pair, a practical application of the Kearney Solderless Service Connector.

FOR Telephone Lines in making party line taps, order Catalog No. 86. The tap can't slacken off. This connector is for No. 12 wire or smaller.

Unassembled Connector

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Kearney Guy Wire Serving Clips. Eliminate Serving End of Strand. Made of Aluminum, Copper, and Galvanized Iron.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

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Air Race Idea Helps in Michigan Extension Sales Drive

Detroit, Mich.—Five divisions of the Michigan Bell Telephone Co. are represented by imaginary planes engaged in a flight of fancy as the pace-making idea featuring the Michigan Bell's second extension sales campaign. All of the company's employes will take part in this two weeks' campaign to increase extension telephone business, and the progress of the competitive efforts will be shown by positions of planes on a large map of the United States.

"The course is laid around the boundaries of the United States, with the starting point at Detroit, and is 17,500 miles long. For each one per cent of quota sold, each division airplane will be credited with 175 miles of traveled distance. Therefore, the division first selling 100 per cent of its quota will be first to fly the course back to Detroit. In case more than 100 per cent of a division quota is sold (we expect a number of them), the race will be continued to select points and the final winner will be the division plane traveling the greatest distance.

"A quota of 3,000 business and residence extension stations has been fixed for the entire Company and has been divided and subdivided by divisions and exchanges. All of the larger exchanges and some of the smaller ones will have definite figures to shoot at in the number of expected sales. These quotas have been determined by a careful study of our extension station development at each of the exchanges involved and those exchanges with a poor development have been given a correspondingly larger quota than those with a better development. Some exchanges have been working hard since the last extension station campaign and have made considerable improvement in their extension development situation; naturally this fact has been taken into consideration in fixing the campaign quotas.

"The development of residence extension stations is still low in Michigan as compared with that of some of the other associated companies, in spite of the fine results obtained from the last extension campaign. In fact, in our state there is only one residence extension in service for every 20 residence telephones, so there is plenty of opportunity to sell more. You may not believe it, but there are a great many people who do not know the story about an extension telephone.

A Few Sales Talk Hints

"When you begin your campaign efforts to sell extensions, think of the possible places that they could be installed. In homes of more than one story and in large apartments and flats, extensions can be installed in bedrooms, studies, upper halls, sewing rooms, sun rooms, kitchens, pantries, cellars—in fact, all convenient points of access.

"Think of the time and energy saved by eliminating extra steps. An extension insures privacy of conversation by making it possible to answer calls from more than one place in the house. If there are guests in the living room, an extension in a bedroom or in the kitchen will be most convenient. An extension is especially convenient where a maid is employed in the home, as then it is not necessary for her to receive her telephone callers at the main telephone.

"The chief points about the value of an extension telephone, however, are its convenience, its energy-saving possibilities, the sense of protection it gives at night and its reasonable cost.

"These days, folks want the best automobile they can afford, the best radio they can buy and all the household appliances, such as washing machines, ironers, electric refrigerators, etc., that the family budget will cover. They should have a telephone layout that is just as modern. It isn't their fault if they haven't thought about it; it's up to us to tell them about the one convenience they have overlooked.

"A residence extension telephone is a low-cost convenience—only 50 cents to 75 cents a month, depending on the rate at the particular exchange, and that's only two or two and one-half cents a day—about the price of a postage stamp. Make the most of the point of cost—it's a good selling argument.

"Before the campaign begins, sales aid cards will be distributed to all employes. Study the suggestions your card contains, for you will find that you can apply one or more of them. Your first prospects will be your relatives, friends and acquaintances; tell them about extension telephones. Then carry the story to the general public, those subscribers you meet in your daily work and those you seek out. The best sales contact, of course, is the personal visit, and the next best is the telephone call. Care should be observed in using the directory as a prospect list, to avoid indiscriminate calling and duplication of effort, thus causing annoyance to some subscribers. For calling purposes, the directory can be divided between departments, and thus some duplication of calls can be avoided.

"Special publicity has been arranged for in the form of newspaper advertising, a bill insert and posters to acquaint the public generally with extension telephones. Your own efforts will have a good publicity backing. Such preparation is general; the real work is up to each individual employe. Each employe making one or more sales will be given an emblem—'the wings of a flier.'

"Mark on your calendar the dates of the campaign, October 17 to 29, and get a bunch of prospects lined up. If each one of us sells only one extension we will exceed our quota four times over.

"Profit by your experiences in the last campaign. If you didn't sell at least one last year, make up for it now. Don't let the other fellow do your work; take up your own responsibility, for it is our responsibility to promote the growth of our Company in every way we can.

"A bulletin will be issued daily during the campaign to keep you posted as to progress being made. Look for it and read it, and if you have some selling experiences that are interesting, tell your team captain about them so the rest of us can get the dope."

Public Utility Financing

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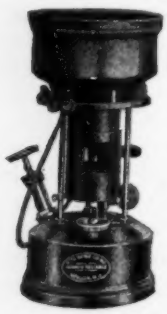
Bernz Adds New Furnace and Torch to Line

Newark, N. J.—Two new additions to the line of Otto Bernz Co., Inc., are the No. 32 gasoline-kerosene torch and the No. 30 self-blowing alcohol torch. The makers call attention to the new style burner of the No. 32 as a burner that will serve for a long time without carbonizing. When the burner eventually does carbonize its replacement is a simple and inexpensive matter. A malleable iron arm that extends from one of the uprights, across the furnace to hold the burner shield in place is another one of the features upon which patent applications are pending. This eliminates three small nuts. Three openings in the top of the reservoir are eliminated by a malleable iron plate brazed to the reservoir to hold the extra heavy uprights.



Patents have been applied for on the self-blowing torch covering a number of features. Some of the points the makers mention as making the device one of high merit are: safety cap that can't be lost or allow evaporation, vent screw that relieves pressure quickly, nickel-plated handles that permit easy carrying or act as stand for torch when in use, nozzle that makes hot flame in any position, nickel-plated brass burner brazed securely to reservoir, heavy spun-brass nickel-plated reservoir and nickel-plated cast brass bottom having three legs for security in standing.

Bell Stockholders Near Half-Million Mark

New York City—In reporting on the third quarter's business for 1927, President Walter S. Gifford of the American T. & T. Co. points out:

"The company doubtless has the largest number of stockholders of any company in the world. There are now over 421,000 stockholders, an increase of 22,000 since the first of the year. Included among these stockholders are 70,000 employes of the Bell system. No stockholder owns as much as 1 per cent of the total. Business of the Bell system continues to show a substantial increase over a year ago. During the past nine months more than $265,000,000 has been expended for plant additions, betterments and replacements. These increased plant facilities have resulted in further improvement in the telephone services."

E. P. Wright, Former Minnesota President Dies

Alexandria, Minn.—E. P. Wright, secretary-treasurer and general manager of the Alexandria Telo. Co. and president last year of the Minnesota Telephone association dropped dead at a meeting in this city October 26. Deceased was 58 years old and had been active in the telephone industry since 1907, when he was made one of the directors of the Alexandria company. He was active in local politics and was long one of the prominent factors in the Minnesota Telephone association.

His widow, a daughter and two sons constitute the immediate family surviving the lamented Minnesota telephone man.

Susanville, Cal.—W. B. Foshay Co. buys local telephone company.

Wilbur Lafean Back with Naugle as President

Chicago, Ill.—Wilbur L. Lafean, formerly secretary-treasurer of the Naugle Pole and Tie Co. and for the last five years vice president of the National Pole Co. has returned to the Naugle organization as president and treasurer. A. T. Naugle, former president and treasurer of the company now is its chairman of the board.

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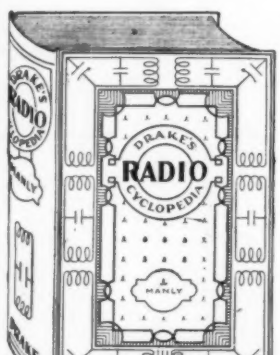

This practical classic on radio contains 871 pages of profusely illustrated material answering every practical radio question from A battery to Zero beat.

Construction, repair, testing, installation, care and operation of radio receivers and power units are handled in a most thorough and useful manner. It is the most complete radio book in print. Price, $6.

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Bores the Hole--Sets the Pole

A pole in the ground every five and one-half minutes is the record recently made on new line construction—under actual operating conditions. A three-man crew with the Highway Earth Boring Machine and Pole Setter bores the holes, sets the poles and moves from position to position all in this remarkable time. A saving of 75% of the time required for the same work by any other method.

The machine mounted on a Fordson or International Harvester tractor, equipped with crawlers, negotiates steep grades and swamps and easily reaches ninety percent of all locations.

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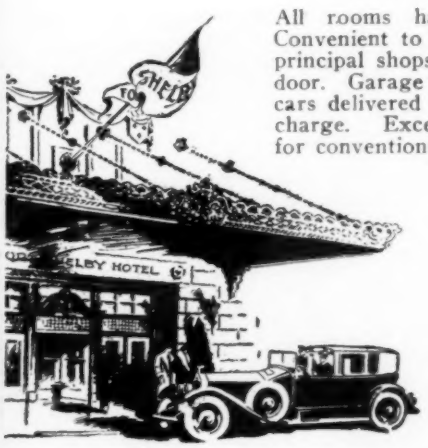

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Guaranteed to give 100% satisfactory service or purchase money refunded.

No. 196—6"	$1.85
No. 96—6" without cutter	$1.50
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Enclose $ ..... (Money Order) for one pair No. ..... Vacuum Grip Pliers.

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T-11

State Chiefs Consider Highway Moves

Chicago, Ill.—The annual meeting of State Association executives was held Tuesday evening, October 18. At this time presidents, secretaries and directors of the various state associations met at dinner and later considered various state problems. The principal topic was moving and changing lines due to highway construction. Albert L. Geiger, general attorney of the National association, spoke on the subject, "Legal and Accounting Problems Arising Out of Pole Line Moves on Highways." Mr. Geiger sketched the background of highway use and ownership and discussed the difference in the situations when the state owned the highways in fee and when ownership rested with adjoining property holders with only an assessment for travel held by the state.

The question for telephone companies from a legal standpoint often hinges on the question as to whether the use for poles constitutes an additional servitude on the highway. Mr. Geiger's contention is that the use by communication pole line is a coordinate use rather than a use subordinate to the use of the highway for travel.

Following Mr. Geiger's address there was a general discussion of the subject and many of the state executives gave resumes of the conditions of their states and the orders of highway commission in the matter of use of state roads by pole lines.

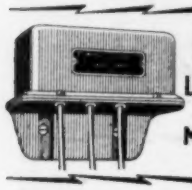
Kansas City, Mo.—Miss Gladys Morrison, daughter of F. E. Morrison of the American Electric Co., Inc., will represent Missouri in the middle west district Atwater-Kent Foundation competition for radio singers. Miss Morrison's voice was pronounced the best in Missouri by radio listeners and judges of the state finals.

Illinois Gets Set for Service Convention

Springfield, Ill.—Final plans have been made for the annual convention of the Illinois Telephone association to be held at Hotel Abraham Lincoln, Springfield, November 17-18.

Keynote of the meeting is "service" and an array of feature speakers is to carry out this policy. An informal departmental conference between plant men and the engineering staff of the Illinois Commerce Commission, represented by Howard Matthews, assistant chief engineer, is to be one of the big spots on the program. An informal accounting open forum, presided over by V. E. Chaney, representing the accounting committee of the U. S. I. T. A., is to be held during the convention.

Center, Mo.—E. C. Hunt of Palmyra has bought local exchange.



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Federal Brand New 4-bar 1000 ohm Bdg. Grab-a-Phones @	8.50
Federal Brand New 4-bar 1600 ohm Bdg. Grab-a-Phones @	9.00
Cook No. 10 Arresters, per bank of 20 lines @	8.50
Cook No. 8 Arresters, per bank of 20 lines @	8.00
Stromberg No. 599 type 4-bar 1000, 1600 or 2500 ohm Bdg. compacts @	6.90
Bunnell 50 ohm Automatic Pen Registers. Register calls from Police or Fire Alarm boxes @	20.00
Kellogg No. 20-A Cord Ckt. Repeating coils @	1.25
Kellogg No. 128 Twin Swbd. condensers @	1.00
Leich Elec. No. 7A Frequency converters @	37.50
Bunnell Telegraph Keys @	.50
General Elec. (THOMAS), A. C. Ammeter, Scale 0 to 2 amps, @	5.00
Dean Elec. 3-bar 1000, 1600 or 2500 ohm Bdg. desk sets @	8.75
Kellogg No. 28 3-bar 1000, 1600 or 2500 ohm Bdg. desk sets @	9.50
Western Elec. No. 296A Straight line C. B. Wood hotel sets with No. 229 Trans., No. 143 Rec., No. 20 Coils and 2500 ohm ringer @	6.50
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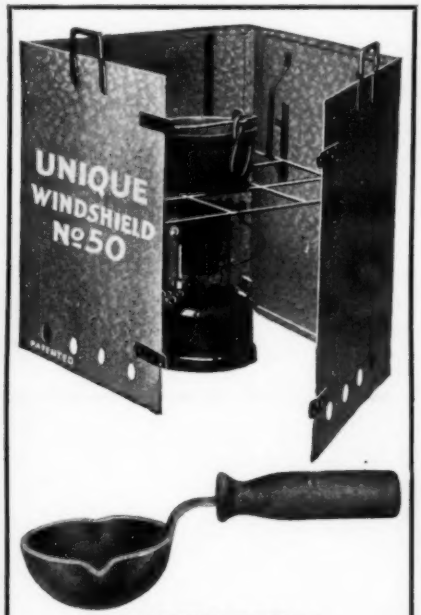
Graybar Opens in Rochester, N. Y., and Flint, Mich.

New York City—Graybar Electric company announces the opening of two new distributing houses, one in Flint, Mich., and the other in Rochester, New York. J. A. Royce, is sales manager in Rochester and H. W. Tincher, sales manager in Flint. The Rochester house is located at 182 N. Waters St. The Flint house is located one-half block east of S. Saginaw St. on E. Third St.

Chicago, Ill.—P. W. Chapman & Co., have bought the Western Wisconsin Telephone Co. with headquarters at Arcadia, Wis.



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LEAVES FROM THE SPORTSMEN'S NOTEBOOK

"Look, Lou, at the 16½ pound fish my boy Charley caught up in Canada this summer," started to relate the eminent Howard Leinard, arch Bell ringer, to the Independent's equally eminent Lou Pitcher of Dixon, while Lou itched to reply . . .

"Nice for a kid," agreed Lou, "but when you get into the grown-up's class, look at my moose. So big that it would take a panorama camera to show it all. Guides up in the north country put the story of me killing this monarch of the forest into their history books. As a nimrod I plead guilty to being a wonder. I'll tell you about . . ." But Howard had fled. Again the gent with the last tale won.

Springfield, Ill.—Commerce commission has been asked to approve sale of Perry County Telephone Co. properties in Pinckneyville, Cutler and vicinity to Illinois Southern Telephone Co.

TERMITE PROBLEM INCREASING

Wood-boring insects cause very large annual losses of timber, lumber and other forest products. In the Manufacturers Record of August 11, 1927, Dr. Thomas E. Snyder of the U. S. Bureau of Entomology, an authority on wood borers, estimates conservatively that they cause a loss of $45,000,000 annually, representing 2 per cent of the value of the yearly cut of forest products. While much of the loss in both crude and finished forest products can be prevented by proper management, based on a knowledge of the life histories of the insects, special preservative treatment is necessary to protect crude manufactured utilized products, such as lumber, dimension timbers, telephone and telegraph poles, mine props and posts, as well as the more finished products, such as interior woodwork, furniture, cabinet woods, etc. The insect most destructive to untreated wood in this country and in the Tropics is the termite, or "white ant."

Dr. Snyder comments on the urgent need to combat these insects, both from the view point of conserving the forests and minimizing the expense of replacement and repair, and calls attention to the fact that the termite problem is becoming so serious with householders that they will soon become dissatisfied and seek substitutes for wood, unless wooden buildings are properly constructed to afford protection from these pests.

There are 42 species of termites in this country, and they are doing great damage throughout the Eastern United States, the Gulf Coast, Southwest, Central West and the Pacific Coast, whereas the popular belief is that they are more or less confined to the Southern States. According to Dr. Snyder, their attack is almost as severe in the "corn belt" as in the more southern portions.

The only effective permanent preventive and remedy is the proper construction of buildings with the knowledge of the habits of termites and "insulation" of all untreated woodwork from contact with the ground. All timber used for lower flooring or foundation work should be thoroughly preserved and metal termite shields should be used. If termites be present in a building after all untreated wood has been removed from contact with the ground they will die out, even if they have penetrated to the height of several stories, since they will have been cut off from their moisture supply in the ground, which is necessary for their life.

Dr. Snyder recommends coal-tar creosote for treatment of wood in contact with the ground, while zinc chloride is the standard preservative recommended for treatment of interior woodwork, furniture, etc., not in contact with the ground.—*Wood Preserving News.*

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